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CHINA: FROM WASHINGTON TO BRUSSELS VIA GENEVA

CAUSES AND CONSEQUENCES

THE CRISIS AT SHANGHAI

Vol. XXXIII SEPT.-OCT., 1937 Nos. 9-10

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXXIII SHANGHAI, SEPT.-OCT., 1937 Nos. 9-10

CHINA: From Washington to Brussels via Geneva

By KIYO SUE INUI, LL.D.

> **"Geneva has displayed a cow in another man's show window in order to stage a sale on consignment of her own goat milk, whereas the shop-keeper is prepared to sell only coca cola," said a humorist.**

In view of the coming conference of the States signatory of the Treaty of February 6, 1922, convened by the Royal Government of Belgium "In compliance with request of the Government of Great Britain made with approbation of the Government of the United States with a view to examining, in accordance with Article VII of that Treaty, the situation in the Far East and study amicable means of hastening the end of the unfortunate conflict existing there," the writer proposes to make a brief study of the so-called Nine Power Treaty in its relation to the present imbroglio and the League of Nations.

Just as some Westerners felt when the Locarno agreements were made that they would cure all ailments of Europe "including headaches," still more people have vaguely remembered that some fifteen years ago the American Government summoned Japan as well as China along with six others to Washington in order to prescribe jointly what they then considered the cure—all for Far Eastern troubles. Geneva, at the behest of China, shook the dust off the prescription and indirectly convoked a meeting of the original nine expert author-consultants and a few more. The questions rehearsed in our minds are: What is the present status of the Pact? Is China still entitled to enjoy its benefits? What is its relationship with the League of Nations? And finally, why did Japan decline the Belgian invitation?

I.—The Present Status of the Nine Power Pact

Unlike certain popular conception to the effect that the Washington Conference concluded only the so-called Nine Power Treaty, among its concrete fruits must be counted at least six treaties, two declarations and thirteen resolutions. The validity and usefulness of these momentous documents are more or less inter-related and interdependent. The key stone of these agreements, undoubtedly, was the Five Power Treaty Limiting Naval Armaments and its main support, the so-called Nine Power Treaty, whose main purpose is the maintenance of the *status quo*, and equality of economic opportunity in China. Our first inquiry, therefore, must of necessity be as to whether the same conditions which prompted the conclusion of the agreements of 1921-2 still form the background of the Far Eastern situation.

(1) The Five Power Naval Treaty, the very foundation on and around which these agreements and resolutions were built, went out of existence. Inasmuch as the sole aim of the Washington Conference was somewhat similar to that of the League of Nations, the former being the maintenance of *status quo* while the latter the enforcement of that status by those who are satisfied with it, the bottom of the Treaty was dropped in London in 1935. For there the conveners of the Washington and London conferences have failed to shift the gear with the changing conditions of the times. It is a strange bit of irony that the world protagonists of *status quo* are now championing the cause of the chronic offender of revolutionary diplomacy and international delinquency, to which we shall come presently.

(2) Since then, it must be remembered also, that a new continental force has appeared in the "direction or Urga," to borrow the language of the late Count Uchida, to modify the Far Eastern equilibrium. This new influence is "no respector" of the dearly guarded *status quo*. Indeed, its appearance owes its origin to the fervent desire to undo the existing order to things. It has directed its most spirited activities to the East. It found in China an apt pupil in copying its revolutionary policies and diplomacy to her advantage, wherever she finds it expedient.

(3) Nor should a student of international relations, ignore the rise of impatient and aggressive nationalism in China, "an aggressiveness in defence, it may be, but an aggressiveness none the less." Of this Mr. Nathaniel Peffer, an eminent authority on Chinese affairs uttered these prophetic words as early as April last:

> "It is difficult just now to say which China has to fear: Japan or China, the ambitions of

WE MAKE ANOTHER APPEAL

Again must we appeal to the forbearance and patience of readers and advertisers, and ask their indulgence for lapses and shortcomings beyond our power to avoid under recently existing conditions in Shanghai. Warfare between Japan and China, in and about Shanghai through recent weeks, has paralyzed all ordinary business activities of the Port, disrupting mail, transport and delivery services, and dislocating all ordinary routine of editorial work. As our establishment is located in one of the main Japanese-owned structures on The Bund, it has been in the forefront of much of the fighting and at times has been under direct shell-fire. Following production under difficulties, and, therefore, tardily of the August number of *The Far Eastern Review* after fighting had begun, we have found it necessary in consequence of the increased scope of the strife through September to produce the September and October numbers of the magazine in this single issue. Adequate adjustments with regard to subscriptions and advertising contracts will be made. Improving conditions in the business section of the Port give hope for a return to an approximation of normal conditions in coming weeks, and this should obviate further need of expedients such as this that has been forced on us, for the second time within the period of thirty-four years through which *The Far Eastern Review* has been published.

> the Japanese army or the state of mind of the Chinese people. The latter, I am inclined to think. For it may succeed in bringing on a war that is not easy to prevent in any case but that could still be prevented."

China, since the Washington days, has dispossessed Japan of Tsingtau, Britain of Weihaiwei; wrested away tariff autonomy from a dozen countries, drove Britain from Kiukiang and Hankow by her newly acquired technique. She became conscious at her moral victory at Geneva in 1931-3. She heard the world applaud her for the valor of her soldiers in Shanghai in 1932. Her pride was much inflated when she quashed the so-called independent movement in Suiyuan last autumn.

> "The truce" (of Sianfu) points out the "Round Table" of September, 1937 "freeing the Nanking Government from its commitments upon one front—against the communists—turned the full gaze of public attention upon the other front—the one against Japan. The pressure upon Nanking to resist, and even to take the offensive, had in recent months become formidable........It was reinforced by the belief, widely held this summer at Shanghai and Nanking, that Japan was passing through such a grave political and economic crisis that she would go to great lengths to avoid war; and by the undoubted successes with which China had met whenever, in recent months, she had chosen to withstand Japanese aggression........"
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> "In March, the Japanese Foreign Minister, under the influence of the business men who, for commercial reasons, wanted a rapprochement with China, made a number of statements that surprised the Chinese by their mildness rather than won them by their friendliness."

The China of the Washington Conference was a sick man, grateful, and meek in the hands of international physicians and was supinely acquiescent. But the China of 1937 is intoxicated, with "recovered possessions, rights and self-assurance. Of the latter," says Peffer "it recovered too much." China of to-day assertive and provocative is not the China of the Washington Conference.

The Washington agreements were the results of the Powers' indulgence, to which Japan contributed most liberally. She is still prepared to be indulgent in co-operating with China in evolutionary rather than revolutionary diplomacy, thereby ushering into the Far East an era of permanent peace. But she will seriously oppose any move that will foster, aid or encourage China's anti-Japanism with or without the "moral support" of distant countries, having little or not interest in China, or that will facilitate the penetration of the untried and questionable political and social theory into Japan to challenge the continued existence of her tradition and culture of 2,500 years.

II.—Is China Still Entitled to Enjoy the Pact's Benefits?

The next question, arguing on the premise that the Nine Power Pact still meets the present international setting in the Far East, is whether or not China is still entitled to the protection of the Treaty, which she seeks? Much has been said already about the alleged violation of the Pact by Japan. The writer has no desire to discuss nor defend that phase of the theme. For that would necessitate an exhaustive study of the definitions of provocation, self-defence and aggression. But it may not be amiss to inquire into the present status of the Pact, in view of the Chinese insistence of its invocation and ascertain if China is really entitled to such a privilege.

(1) It will be remembered that, including among the series of the Washington arrangements, there is a resolution providing for the establishment of a Board of Reference, for Far Eastern questions, to which those "that may arise in connection with the execution of the provisions of Articles III and V of the Nine Power Treaty, may be referred." These articles relate to the so-called open door policy and equality of economic opportunities in China. China, though willing to accept the fruit is delinquent in fulfilling her obligations and she skilfully avoided, to this date, the creation of the Board on the ground that it would infringe on her sovereign right.

The writer is not unaware of a glib argument by young Chinese publicists that no effort has been made to convene such a Board by any one, as if to say that it would relieve China of that responsibility. No particle of doubt is left on this point, if one reads the minutes of the sixth plenary session of the Washington Conference which includes the following. "The special Conference provided for in Article II of the Treaty to be signed at Washington on February 6, 1922, with reference to the Chinese Customs Tariff shall formulate, for the approval of the Powers concerned, a detailed plan for the constitution of the Board (of Reference)." We shall presently see how this provision has been left unfulfilled.

(2) The second violation by China of the Washington group of agreements relates to a conference agreed upon at Washington to which we have just referred. It was to be held in Peiping with a view to increase her customs revenues in order to enable China to meet her fiscal requirements and abolish likin throughout this Republic. To that end the interested Powers met in conference in Peiping in 1925 and 1926. But on account of Feng Yu-hsiang *coup d'état* and Li Chung-lin uprising, the host delegates disappeared one by one and the conference came to a standstill. However, China subsequently obtained her objective, not at a conference as was provided for in the Washington Convention, but by unilateral threat and international cajolery. The nations were forced to acquiesce the *fait accompli* without any further ado and without seeing anything of the Board of Reference, the creation of which was charged to the defaulted conference. Nor can we say by any stretch of imagination that China has abolished likin as was expected at Washington except in name.

(3) The third delinquency on the part of China relates to a Resolution regarding the "Reduction of Chinese Military Forces." It expresses to China an earnest hope that immediate and effective steps be taken by the Chinese Government to reduce her military forces and expenditures. However, since then China has shown no disposition to reduce her armed force, on the contrary she maintains a vast army or armies of several millions, of whom Canton alone boasts 1,000,000.

Europe and America are concerned with the question largely from economic point of view. Their primary interest in China is China as a potential customer. To Japan, just how many troops there are on this side of the Yellow Sea and how they look upon Japan and Japanese are the matters of vital importance.

(4) Furthermore, as regards the oft repeated open-door policy which constitutes one of the cardinal principles of the Nine Power Treaty, for the last few years it has been made extremely difficult for Japan to enjoy her rightful share in the Chinese market or otherwise in economic participation of this country, due to boycotts and various anti-Japanese activities and outrages. Even where the Japanese outbid all others the Chinese would not grant them the announced and promised contract, thereby utterly disregarding the fundamentals of the Treaty which she has succeeded in invoking.

With these eloquent facts of non-fulfilment of the terms of the agreements and the change of the conditions from that of 1922 to the one now obtaining, Japan cannot easily be maneuvered by the nicety of diplomatic language and courtesy into safeguarding the stable from which the horse has already run away and when Japan herself is charged with crime of removing it.

III.—The Nine Power Pact and the League of Nations

The League of Nations, as such, has little or no claim within the frame work of the Washington agreements. When they were entered into, the Powers concerned never envisaged their complicity with the League of Nations. The Washington Conference, according to some critics, was sponsored by President Harding partly, prompted by an alleged subconscious desire of covering up the uncomfortable track that the Republicans chose to tread in opposition to the Wilsonian Democrats. He considered undoubtedly that the League was an essentially European concern, in which he discerned the possible political entanglement and accompanying dangers. Hence in the Washington conference he saw to it that none of these dangers was embodied in the documents. The principles there involved can be characterized as those of confession of faith, abnegation and for consultation.

The Geneva organization fortunately or unfortunately has gone far beyond the participants of the Washington agreements have ever envisaged and already marked out its own course with such hastily gathered materials, as it has, without those from Japanese sources. No one with ordinary intelligence can persuade himself to believe that the League expects to lay before the Members of the Nine Power Conference a blank sheet on the conference table when they meet under its auspices, direct or indirect.

Japan is no longer a member of the League, and it is not to be expected that she would accept an invitation to the conference especially when she does not believe that she has violated any of the terms of the Washington Treaty and when she senses the breath that League breathed into its nostrils. Japan would view the step with natural apprehension. For the Treaty in question provides no such procedure. We are unable to discover in the series of the Washington arrangements no mention of such a multilateral conference.

The only conference which was envisaged at Washington finds its concrete expression in the Treaty relating to the Special Tariff Conference which China defaulted, as we have already seen. Because of that she forfeited the right to create a Board of Reference which was charged " to deal with the questions that may arise in connection with the execution of the provisions of Articles III and V of the Treaty," commonly known as the Nine Power Pact, though these articles relate only to the questions of the so-called open door.

All that the invoked Treaty suggests is that in case when a situation arises which, in the opinion of any of the signatories, involving the application of the stipulations of the Treaty, and rendering it desirable to consider the matter, " there shall be a full and frank communication between the contracting Powers concerned." Without being squeamish on the grammatical use of the preposition, " between " preceding " the contracting Powers," which usually means between two parties as distinguished from among more parties, Article VII foresees " a full and frank communication " between the Contracting Powers concerned. But whether that goes beyond those who have since adhered to the Treaty is very doubtful. Naturally a " full and frank communication " may lead to a conference. Such a conference is an outgrowth apart from the Treaty but not of it.

Japan will hardly consider the convocation of the proposed conference at Brussels at the instance of the League which has a definite course of action or inaction in its archives as " a full and frank communication " stipulated in the Washington agreement. Rather would she consider it a summons, as it were, to adjudicate the Far Eastern affairs by a jury whose conclusions are already reached. It must further be remembered that some of these nations have officially pronounced their judgment before Japan received the official invitation. But the worst of all it was the *laissze faire* attitude of these very countries concerning the promised Round Table Conference following the Truce Agreement of 1932 in Shanghai that is largely responsible for encouraging China to initiate the present calamity.

IV.—Why Did Japan Decline the Belgian Invitation ?

Rightly, or wrongly, it has been Japan's avowed policy to free the Far East from that despicable international technique to which China traditionally has resorted. Japan considers the Geneva suggestion not so much as an expression of collective peace but as a method of trying to control " one barbarian by a group of barbarians," a system which Japan is determined to eradicate from this part of the world.

Japan has patiently waited to talk directly with China. There are some who seem to think that simply because the Japanese and Chinese Ambassadors have remained in their respective posts and have conferred now and then with the foreign ministers of the countries to which they are accredited, they are engaged in direct negotiations. Far from it. For Geneva has made certain impossible decisions from the Japanese view point at least, among which is included the non-recognition of Manchoukuo as an independent state and virtual international control of China, if the Lytton report has not yet found its way to a waste basket, and the recent declaration by Geneva's Advisory Committee that " the Conflict cannot be settled directly between Japan and China." Japan, on her part, is strongly of the opinion direct negotiations between the parties in conflict are the first and best course between the two neighboring nations, which are bound to have constant and multitudinous problems arising out of their intimate contracts.

It is not too late for some of the over zealous European nations to admit the fact that Geneva alone is not the only seat of impartiality nor the source of wisdom, and that the nations have not surrendered their primary right of trying first to settle troubles with their neighbors among themselves. The League will be considerably strengthened by taking such an attitude ; and its present difficulties will be greatly minimized thereby. Short of that, we are inclined to believe that it will merely aggravate the situation without fairly and legitimately showing to Japan the just cause for intervention in a proper field in a proper manner.

Causes and Consequences

By C. J. LAVAL

At the beginning of the grey month of November when the Shanghai war was entering its twelfth week it was estimated that the Chinese casualties in this single region southwest of the Yangtze estuary, dead and wounded, had mounted roughly to a quarter of a million. Along with the tremendous losses of life, the destruction of property in the Shanghai area resulting from the fighting has grown into many hundreds of millions. This is an appalling record of loss. Both China and Japan have suffered immeasurably, and the end is not in sight.

This catastrophic spectacle in the Far East has horrified the entire world, in greater measure than did the lesser clash of arms at Shanghai in 1932, and the horrors of both conflicts was brought the more sharply before the world's notice because these two acts of a single vast tragic drama were enacted on a stage directly beneath the eyes of news correspondents from far and near. They could follow the action of it all in safety and comfort from their hotel windows and so were enabled to present every last fearsome detail, embroidered to suit varying overseas circulation demands, to an avid audience of Occidental readers. On the basis of these day to day records so presented, the great public outside of the Far East, stirred simply by the events of the passing hour, has assessed the blame for the whole conflict, and has named Japan the culprit.

The dignitaries at Geneva, each with his own national interest in mind, have enunciated profound opinions on the legalities and on the international aspects of the controversy in the Far East. Diplomats of all degrees in the world capitals, and now latterly at Brussels, have directed efforts to analyse the situation as it conforms with, or fails to conform with, terms of treaties and covenants. Whatever may be the trend of popular world opinion resulting from these proceedings, it is probable that future historians will write that the deplorable and costly war between China and Japan was an inevitable consequence that grew out of the sequence of international events through the decades that preceded the conflict. Natural laws take precedence over the highest and holiest concepts of human kind, and self preservation, the first law of nature, applies with equal force both to individuals and to nations. Herein is found basis for a viewpoint recently expressed by Roger Babson, noted American economist, who is an outstanding authority on his subject. Briefly, the opinion of this American authority is that the great powers of the Occident are to be blamed for the war in the Far East.

Problems Japan Faces

Through the past quarter of a century Japan's internal necessities have grown increasingly acute while conditions that have confronted her in the world outside of her own Empire, year by year, have become ever more difficult. To provide for a population of more than half that of the United States within territorial limits of an area less than the single state of Montana, compelled Japan to cast her eyes overseas in search for relief. To the north, she could see only the frozen arctic seas ; to the east and to the south, the gateways of all other lands were closed to her people. Intensive industrialization to which she was obliged to resort, thrust her into commercial competition with the rest of the world from which she had to obtain the raw materials, lacking within her own borders, for her factories and her industries. Her population increased relentlessly and then under spur of business interests that were feeling the sting of Japanese competition in world markets, governments in every part of the world began the erection of trade barriers and the imposition of trade quotas to check Japan's invasion of world markets and to protect their own industries. As a further step in this direction, measures were brought into play to shackle Japan's access to the raw materials she has to have to keep her factories busy and feed her growing population. At Washington, in 1922-23, diplomacy sought to rivet the inflexible bands with which the rest of the world was encompassing Japan, doing nothing to help relieve the ever increasing pressure within the Empire.

Through these years, lagging far behind and out of step with the modern world, China, torn with internal strife, was struggling ponderously with her own difficult problems. Through the first two and a half decades of the century she remained scornful of the western technique of civilization, which Japan had embraced so ardently in the middle of the preceding century, and characteristically hostile to all alien influences, her hatred of the Nipponese sharpened as she saw that little neighbor nation grow into the stature of a world power. This animosity took the form of trade boycotts, restrictions where they could be imposed and a widespread fostering of ill will and suspicion.

Japan's earlier approaches in dealing with China in the years of the World War may have been ill-advised, but evidence is not lacking which indicates that the historic "Twenty-one Demands" that took form in Peking in 1915, may not have been wholly a Japanese inspiration. In any case, the demands came to nothing. The realization had been thrust upon Japan that her only hope to survive as a nation lay on the mainland of the continent of Asia, and added emphasis was given to this realization by the United States in 1924, when American immigration restrictions, as these applied to Japan, were tightened, a needless affront to the Tokyo Government. It was under American pressure after the World War that Japan was forced to yield the foothold she had won from the Germans in Shantung province, and insistence of the Government of President Woodrow Wilson—toward which other allied powers were rather less than lukewarm—obliged Japan at length to withdraw from Siberia and surrender any hopes she may have held in that part of Asia to the signal advantage of the forces of the Moscow Bolsheviki, then advancing eastward toward the Pacific.

The Birth of a Nation

The chaos in China reached a climax in 1927, when the alliance that Dr. Sun Yat-sen had made with Communist Russia was broken off and the Comintern representatives, who, until then, had been guiding China's policies, were ejected. General Bluecher, to-day in supreme command of the formidable Far Eastern army of the Soviet Government in Siberia, was one of those to go. At that time he went by the name of General Galens, and it is said that his masterly strategy in large measure enabled the Chinese armies to complete their victorious march from Canton to Wuchang on the Yangtze. This year of 1927 saw the birth of the existing National Government of China under Generalissimo Chiang Kai-shek, and it will perhaps be written that the past decade in China under Generalissimo Chiang was one of the most notable periods in the long history of the country. The progress and reconstruction within China, through this period, in a measure parallels the phenomenal strides in westernization and modern progress made earlier by Japan on her march toward the status of a power of the first rank.

This initial step toward the unification of China led to a significant change in Manchuria. The three northern provinces of Fengtien, Heilungkiang and Kirin that comprised Manchuria for years had been an entity independent of the rest of China under the ruthless old overlord, Chang Tso-lin, who, it is said, dreamed of founding a new dynasty and looked forward to a day when his son would mount the Dragon throne as Emperor of all China. While never subservient to Japan, old Marshal Chang Tso-lin had the wisdom to follow a policy of "live and let live" with regard to the Nipponese within his domain, and never openly, at least, did he put in motion active measures seriously harmful to the vast interests in Manchuria that Japan had developed from those she had won in her war with Russia, such as the South Manchuria Railway and its numerous rich subsidiary properties and the Port of Dairen. His was an absolute if discreetly prudent rule and from time to time he was wont to buttress his position with Declarations of Independence addressed to the Government in China and to the world at large.

On June 4, 1928, at the time the National Government of China was taking its first steps as an infant regime, Chang Tso-lin was murdered in an explosive blast that wrecked his railway coach on the outskirts of Mukden in an assassination which never has been adequately explained. His son, the "Young Marshal," Chang Hsueh-liang, came into power in Manchuria. In the Autumn of that year when the newly formed Nanking Government was facing a revolt of two powerful Chinese leaders in North China, through a remarkable piece of statecraft engineered by General Wu Te-chen, former Mayor of Greater Shanghai, and now Governor of Kwangtung at Canton, the Young Marshal was brought to heel for the Nanking Government when he accepted the authority of Nanking without reserve.

Japan Sees Shoals Ahead

Japan had been watching the course of events in Manchuria with anxiety. The expanding power of armed Russian Communist forces in Siberia and the spread of Russian influence in northern Manchuria stirred her apprehensions which were quickened anew when Chang Hsueh-liang departed from the policies of his father, surrendering his independence and yielding allegiance to the new Government at Nanking whose leaders, countenancing the boycott and other measures hurtful to Japan, had remained unmoved by conciliatory gestures made in Tokyo under the regime of Baron Shidehara as Foreign Minister through that period. The Japanese fears were well founded, for a program in every way adverse to Japan's interests in Manchuria was actively pursued through the next two years and a half. The clear purpose of all this was to throttle Japanese commercial interests that represented, in the aggregate, an investment of two billion yen. It was made increasingly clear that the purpose of the Mukden regime under sponsorship of the Nanking Government was to drive the Japanese out of Manchuria. Japan's sense of resentment was heightened the more by the knowledge she had gained tardily that China actually had been the ally of Russia in the Russo-Japanese war. Japan only became aware of this at the Washington Conference in 1922, seventeen years after her costly struggle with Russia, for which she still is paying. The fall in revenues and profits of the South Manchuria Railway through this period, as shown in published records, tells eloquently how well the movement to oust Japan from the mainland had begun to succeed.

In view of this record the futility of the question who fired the shot that began the Manchurian outbreak in 1931 is apparent. They were being thrust out of the country and the expanding power of communist Russia loomed like a dark shadow over them and across Korea. They saw their only hard-won foothold of value on the mainland being taken from them and they were convinced they were facing actual extinction as a nation. This is the basis for their contention that they acted in self-defence, their answer to the charge they violated the terms of the Nine Power treaty. And it is true that it is an accepted tenet of international law that despite treaties a nation may act in self defence and, further, it is left to the discretion of the nation itself to judge when occasion for self defence has arisen.

After all the oratory at Geneva, Japan's withdrawal from the League of Nations and the formation of the new State of Manchoukuo, events in China under a Government of increasing power and prestige became geared to a speedier tempo. The troublous years in North China that followed, were a time of feverish preparation for the Nanking Government, and how thorough was that preparation has been demonstrated amply, on the battlefields of North China and, particularly, in the bitter warfare of the past three months in the Shanghai region. It was while these preparations for strife were going forward in China, that Japan began to feel most acutely the pressure imposed by nations all over the world in a time of business depression to close world markets to her with higher tariff walls, trade quotas and the like. It is this external factor that the American economist Roger Babson finds to be the real underlying cause of the war in China to-day.

As An American Economist Sees It

"Actually," he says in an article recently published, "the great western powers set the stage for the struggle. Tariff decisions of the United States, England, France and other industrial nations lie behind the Japanese aggression in North China." He insists that "the roots of this trouble are economic and deep and they must be dug up or the conflagration must spread. While parts of the world are prospering, other parts are starving. Foreign trade, the life blood of world prosperity, dried up to just a trickle in 1933 and 1934. It has slowly been recovering, but still is far under normal level.

"The economic systems of those nations which depend on others for their raw materials and markets for their finished goods have been thrown completely out of gear. Three of the so-called trouble-maker countries of the world to-day belong to this group—Germany, Italy and Japan. These nations are suffering desperate economic pains. Germany and Japan particularly depend on world commerce. Lack of credit, rising world prices, currency devaluation—and, most important of all, higher tariffs—have crowded both these nations back against the wall. They feel that the other great powers have cheated them, and abandoned them. They know that they must seek their own salvation, that the law of the survival of the fittest applies to nations as well as to individuals. Germany's troubles date back to the World War, the Versailles Treaty, and the destruction of her credit during inflation. Japan's problems are of more recent origin.

"In 1854, when Japan first engaged in commerce with the west she was 500 years behind the Occident industrially. Her tremendous progress since then is one of the greatest achievements of the modern world. Perhaps she has grown too fast industrially. At any rate, she is, to-day, a most efficient and low cost manufacturing nation. Her little island empire, must feed a population more than half the size of our own and five times that of Canada.

"She has, no great colonial empire, such as Britain's, to provide supplies for her industries and market places for her goods. She must draw her raw materials from overseas and there, also, she must find the outlet for her finished goods.

"It was our own Commodore Perry who pried open the doors of Yokohama and started Japan on her modernization program. We have secured more benefits from it than any other nation. We have sold millions of dollars worth of machinery of all kinds to hasten the process. So far this year 11 per cent or U.S.$140,000,000 of our total exports have gone to Japan. Yet in return we have bought only U.S.$92,000,000 worth of goods, or six per cent of our imports from her.

"Raw materials are the principal item which we send across the Pacific. For instance, Japan took more of our 1936 cotton crop than any other nation—even more than England.

"Foreign purchases can be paid for only with gold or with surplus products. Japan cannot pay us with gold—for she has none with which she dares part. She can and does pay us partially with silk, but our chemically made rayon has raised havoc with Nipponese silk farmers. She cannot pay the remainder of her debt in other surplus goods—which, in her case, are manufactured products—because she cannot scale our tariff barriers.

"She has the same trouble with most of the other western nations. They are all eager to sell to Japan, but they do not want to buy her goods. Hence, Japan, in desperation, seeks new territory which will give her needed supplies of raw materials and an outlet for her finished goods.

"During the last two decades, while the world has been shouting for an end to military wars, it has been deliberately, with our aid, starting a far more dangerous war—A battle of economic barriers. In the end, these barriers lead desperate nations into wars of aggression, such as the current conflict in China. Moreover, Germany, Italy, and other stifled nations may try the same 'way out' at any time."

Purposes That Failed

These are simple truths—that there are things within China that Japan desires greatly, things that she deems, perhaps, to be vital necessities for her well-being, but Japan did not want a war with China. To this may be added that China did not want war with Japan, if the words of her responsible leaders mean anything at all. Japan's real purpose had been to pour needed capital into China, and working with this in amity with the Chinese, to replace archaic and primitive production methods with efficient modern procedure of the kind Japan has learned so well from the Occident, which has placed her in the forefront of trading nations. In this purpose in protracted discussions in London several months ago she sought to obtain British acquiescence and British co-operation, and her efforts in this direction were being cordially received. Her statesmen repeatedly have declared, and still declare, that Japan does not seek territorial gains in China, and financial and commercial leaders of the calibre who have built modern Japan would never expect to obtain from China the raw materials they require so badly without the essential *quid pro quo*. This is the theme of everything her responsible statesmen have been asserting—that the purpose sought is real co-operation between the two nations for mutual benefit, and assent to the achievement of this purpose had been given by a responsible portion of influential Chinese in both commercial and official life.

Lesser but powerful subversive groups, radicals and communist elements, and badly informed patriots within China bitterly opposed these aims, as they have ever opposed orderly, peaceful methods, and were quick to make capital of tactless and ill-advised utterances of Japanese militarists, whose untimely published statements were deplored in Japan as they were in China. This is confirmed by the fact that on orders from the highest military councils in Japan sharp restraints tardily were placed on published statements by Japanese military officers.

Madame Chiang Kai-shek recently published an arresting narrative about the incident at Sian last December when the person of Generalissimo Chiang Kai-shek was seized by rebellious troops and when, as a captive, he was brought into close contact with the Chinese communist elements that had been directing the Chinese communist armies. All that took place there in Sian before the Generalissimo was released, however, certainly has never been made public, and it is well within the realm of probability that the Chinese commander's hand was forced at that time. Termination of civil strife in China by ending the long warfare against Chinese communist forces, the powerful argument that whatever their quarrel might be, it was madness for armed Chinese forces to continue to fight and kill each other within the country at a time of national crisis, and, most potent of all, with China armed and prepared as she had never before been in history, the proposal of union of all Chinese elements and armed alliance of Chinese communist armies with those of the National Government with the one purpose of making war on Japan, was vigorously urged. The sober realists in China who had hoped and striven for peace were overborne in an avalanche of nationalist sentiment. Thus was the ground made ready for slaughter. It may be that the first shot fired at Lukuochiao last July may turn out to be not unlike that other first shot which was fired at Sarajevo in Serbia in the Spring of 1914.

The catastrophe was thrust upon the two nations by minorities. Deadly elements with highly explosive affinities for each other were permitted to come too closely together—like a seepage of gasoline fumes in a candle-lighted chamber. There seems apparent the outlines of a well-considered design in the shifting of the main theater of warfare into Shanghai. The goals at which Japan has been aiming all are in North China. There was nothing for her to win at Shanghai, or in central China, where she could only be drawn into undesired complications with British, French, American and other Occidental interests. It is fantastic, therefore, to suppose that Japan desired to make war in Shanghai. Reason and logic support the Japanese assertion that she sought by all means to avert "incidents" in the Yangtze valley such as might have arisen after any of the series of assassinations of Japanese nationals in preceding months.

The Yangtze Evacuation

To avert such dangers she evacuated her nationals from all the inland ports on the Yangtze, at the same time removing her gunboats from that waterway. The only place to which these refugees could be brought for embarkation to their homeland was Shanghai, and the fleet of Japanese warcraft from the river, gunboats and lesser armed vessels, could only come to Shanghai. It was the appearance in the Whangpoo of this concentration of naval strength at this time of tension that galvanized armed forces at Shanghai into activity, although at that time Japanese naval forces were outnumbered more than ten to one by the Chinese troops immediately surrounding the foreign settlements of Shanghai. One eminent opinion on the Shanghai war that carries the weight of intimate exact knowledge of Far Eastern affairs was expressed in October by Sir Francis Lindley, former British Ambassador to Japan.

"There can be few who have closely followed events in the Far East," he wrote in a letter published in the *London Times* on October 11, "who are not convinced that the Chinese maneuvered the Japanese into the campaign around Shanghai, with the double and perfectly legitimate object of creating a diversion from the struggle in the North and embroiling Japan with the Powers. The Chinese have succeeded in their first object beyond expectations, and if we listen to the advice of those who have never yet been right on any subject connected with foreign affairs, they will succeed also in the second."

In this communication Sir Francis adds that he has not yet met any man with common-sense who believes that any ultimate good can come to the Empire, or to European civilization, from a policy of sanctions or boycott. He concludes by urging the British Government to secure the abolition of Article XVI of the League of Nations Covenant, which deals with sanctions, "for as long as that Article stands there can be no appeasement between nations, nor any relaxation of the policy of self-sufficiency, which is the bane of the world."

Elements of the Boycott

It is unlikely that British and other great Occidental commercial interests will wholeheartedly endorse the British diplomat's views on sanctions at this precise juncture. The boycott, with all its deplorable qualities, does carry values for interests untouched by it. Britain learned sadly the truth of this in 1925 when commercial rivals in the Far East promptly availed themselves of opportunities to acquire British trade then being diverted by a Chinese boycott. While Japan in her commercial expansion has been able to garner but a scant three per cent of world trade, losses occasioned by her incursions into world markets have been more or less centered on specific industries. In numerous cases she has seemed able to clamber over the highest tariff walls and to surmount difficulties of most drastic quota restraints. This has caused anguish in overseas industrial areas, and urgent demands for additional measures to relieve the pressure of Japanese competition. It does not seem likely that these injured commercial interests would at this time forego the chance to use a new weapon ready fashioned in China for their purposes in the commercial field.

Governments can give no official approval to sanctions, but extremely effective penalizing measures against a power can be set in motion unofficially, as is being done now in England, when public opinion is swayed by published accounts which tell that the Chinese have suffered a quarter of a million casualties in the warfare at Shanghai. It is true that even this staggering total of human loss represents roughly only about twenty per cent of the number who starve in China in one of the recurring years of severe famine, but famines have no such appeal to public emotion as shell-fire and bomb explosions, and they cannot be capitalized for commercial profit. Besides, famine reports from China through the years have become so commonplace that in these later times they can find obscure position only on the inside pages of newspapers, if printed at all.

At the time this is written the single hope for early cessation of the conflict in China seems to be centered, and dubiously, at Brussels, where statesmen are gathered solemnly to talk about the Nine Power Treaty. After her experiences at Geneva five years ago Japan, with reason, is most chary of these European round-table conferences, and her leaders have deemed it prudent to decline the invitation to attend the Brussels meeting.

The fighting continues, and the tremendous losses to both nations keep piling up in a conflict of machines against man-power, for numerically the Japanese are far inferior to their foes, and they have need to call on every resource of that great fighting spirit that is traditional in the Nipponese armed services. An anxious world professes surprise at the bitterly gallant defence of the Chinese, forgetting that back in the 'sixties of the last century, at the time of the American Civil War, the American soldier of fortune, General Frederick Townsend Ward, and after him, the British General, "Chinese" Gordon, both leaders of the same Chinese army, proved abundantly that the Chinese soldier is a first-class fighting man. So again in 1937, this old truth is being made manifest, but—what can they win, and what must they lose? One calls to mind the title of a book written a few years ago by the British author, J. O. P. Bland—China, the Pity of It!

The Crisis at Shanghai

THE tension created by the outbreak of hostilities in north China spread with electric speed to other sections of the country, as the Central Government at Nanking began to push warlike preparations on a major scale. Japan hoped and believed that the minor clash at Lukouchiao could be rapidly settled locally through the process of friendly negotiation, but, as confirmed by subsequent Chinese moves, a section of China's leaders had other intentions—to capitalize on this opportunity to rally nationwide support around the Nanking Government by a campaign of armed resistance against Japan. Anti-Japonism which was being implanted in the minds of the Chinese masses as a unifying symbol—a common rallying point of diverse and conflicting internal interests—at first abstract, but eventually concrete, as the movement gained momentum, turned with the north China clashes into a general crusade.

Forcefully conducted as a matter of official policy, anti-Japonism had gained considerable headway during the previous two years. Murders and other acts of violence occurred with increasing frequency. Every attempt to remedy the relations between the two countries, every offer of co-operation made by Japan, was turned down. The tide of anti-Japanese agitation rose higher and higher.

Availing themselves of the tense situation which followed the outbreak of hostilities in north China, anti-Japanese agitators began a spirited campaign for resistance against Japan and fanned the flames of hate throughout China. This widespread movement resulted in a continuous series of anti-Japanese demonstrations and meetings, creating situations fraught with danger in many parts of the country. Chinese merchants, dealing with Japanese, were mercilessly persecuted as traitors and Chinese in the employ of Japanese firms and homes were subjected to great pressure and were forced by intimidation to run away from their employers. Japanese merchants in China, in many cases, were thus compelled to discontinue their business, while Japanese nationals, in general, were subjected to extreme inconveniences in their daily life. At some places Japanese women and children were made victims of Chinese violence. These anti-Japanese activities finally culminated in interference with the supplying of food and water to Japanese nationals.

Such conditions made the occurrence of untoward incidents extremely likely, and, feeling the necessity of avoiding any clash which might arise between Chinese forces and the Japanese gunboats patrolling the Yangtze, the Japanese Government advised the Japanese nationals in the upper reaches of the Yangtze Valley to withdraw to safer places. Thereupon the entire Japanese communities at Chungking, Ichang and Shasi, numbering 35, 107 and 12 respectively, evacuated on August 1, and 96 Japanese residents of Changsha followed them on August 4. Hankow's 1,785, concentrated on board two steamers, embarked there on August 7, escorted by three naval vessels. On the following day the wholesale exodus continued from Kiukiang (76 Japanese), Tayeh (12), Wuhu (40), Nanking (431), and Chinkiang (13). All those evacuated reached Shanghai by August 9, under escort of Japanese gunboats.

In this connection, Hankow, the great distributing center of the four provinces of Honan, Hupei, Hunan and Szechuen, deserves special mention, for Japanese traders had developed an important market there after years of industrious endeavor and enterprise. They dealt in the export of Chinese wood oil, raw cotton, cereals and other products of the provinces and in cotton yarn, cotton cloth, sugar, marine products and general merchandise as items of import. Their trade amounted to about 60,000,000 yuan annually. Beside this, the Japanese have invested capital to the extent of 40,000,000 yuan in this inland center.

Hankow, just prior to the evacuation, had a total population of 742,000, of whom 2,238 were foreign residents including 1,738 Japanese.

After the evacuation of the Japanese residents at Hankow, a special detachment of the Japanese Naval Landing Party at Shanghai, which had been dispatched to Hankow to protect the Japanese Concession there, and the Japanese warships in charge of protecting Japanese lives and property in the Yangtze Valley, all withdrew to Shanghai on August 8. It seems that the Chinese viewed this gathering of ships—mostly gunboats of 170 to 305 tons and torpedo boats—as an aggressive display of force and as constituting a great menace. That such allegations are wide of the mark need not be stressed, as this condition was but the result of Japanese evacuation of the upper Yangtze Valley.

The Japanese who evacuated from the upper Yangtze area totalled approximately 2,800. Their homes are located at various places extending inland as far as 1,400 nautical miles from Shanghai. Although the lives of Japanese nationals were thus secured from danger, the loss in property and in economic interests which they had built up after years of arduous toil was incalculably great—especially if the Chinese authorities to whom the protection of these interests was entrusted fail to discharge their trust.

The withdrawal of all Japanese nationals from the upper Yangtze Valley was viewed by various nations, particularly China, with grave misgiving, as it was interpreted as an indication that Japan was preparing for widespread hostilities. This was far from the truth. As Mr. Tatsuo Kawai, spokesman of the Japanese Foreign Office, explained at the time, the Japanese Government's decision was motivated principally by the desire to prevent the possible recurrence of such untoward incidents as the Tungchow massacre on July 27, this year, in which over 200 Japanese nationals, including women and children, were victims of unspeakable atrocities.

It was purely a precautionary measure. Untoward incidents might not have occurred in these inland regions, but the Government had no other course in view of the rapidly spreading acts of terror against the Japanese and even against Chinese having business or other affiliations with the Japanese. A single incident involving the lives and property of Japanese would have required Japan to act at once, and this would have meant aggravation of the situation, which she was doing her utmost to avoid.

Intensification of anti-Japanese activities became so great that even members of the Japanese consular staffs at Chungking, Changsha, Ichang, Shasi and Kiukiang were compelled to evacuate.

So they all assembled at Hankow by August 8, and three days later sailed downstream for Shanghai. But due to the Chinese blocade of the Yangtze River near Kiangyin, they were forced to turn back to Nanking. From there they proceeded to Pukow, where they boarded a special train for Tsingtao on August 15, eventually reaching Japan.

The last party of the Japanese to withdraw from the interior were the officials in Nanking, including Mr. Shinrokuro Hidaka, Counsellor of the Japanese Embassy in China, and staff members of the Japanese Consulate General in the capital. Assembling on the morning of August 16, at the Nanking Office of the Japanese Ambassador, these officials sang the Japanese national anthem, "Kimigayo," and, after lowering the national flag from atop the office, boarded a special train provided by the Nanking Foreign Office at 4.00 o'clock that afternoon. Escorted by 50 Chinese gendarmes, they went to Tsingtao by the Tientsin-Pukow Railway.

On the occasion of their withdrawal numerous courtesies were extended them by the American Embassy at Nanking, while the Italian Ambassador called on the Japanese counsellor in person to express his sympathy in connection with the evacuation.

Concentration Around Shanghai

The first exchange of shots between Chinese and Japanese troops in the outskirts of Peiping on the early morning of July 8, incited China's huge armies to action, and so gave concrete form to the long cultivated hatred against Japan. While tens of thousands of soldiers moved northward, not only to engage the Japanese in a major conflict but ostensibly and ultimately to exterminate Japan's peaceful and legitimate enterprises in north China, large forces began to concentrate near Shanghai, creating a strong feeling of tenseness in that cosmopolitan city. Large units of the Central Army which had already been massed at different points not far from the city for many months past, began to close in under various pretexts. The Shanghai Peace Preservation Corps, whose number was fixed at 5,000, rapidly grew in size. By the early part of August, its strength had been increased to over 10,000 and its various units were fully equipped with trench mortars, field pieces, armored cars and light and heavy machine-guns.

The Corps was a Chinese organization created for the maintenance of peace and order in the native sections of the city and other adjoining areas which were demilitarized by the Sino-Japanese Truce Agreement of 1932, yet from its very inception it was not an ordinary police force but a cross between a police unit and an army with a stronger leaning toward the latter, except for the uniform. With the beginning of hostilities in the north it became the Chinese army in disguise. Gun platforms were constructed, sand bag and barbed wire barricades were erected, trenches were dug, not everywhere, but chiefly around the eastern sector of the International Settlement, where the homes of 30,000 Japanese nationals are concentrated.

The Chinese claim that they sent armed forces into the Shanghai area for self-defence against those of Japan which, by entering the demilitarized zone first, were the first to violate the truce agreement, thus rendering it null and void. As a matter of fact, as early as October last year, the Chinese began to concentrate troops at strategic points in and near the demilitarized area. Investigations at that time revealed that 3,000 troops of the 36th Division of the Central Army were massed at Nanziang, 13 miles within the demilitarized zone and less than 10 miles from the heart of Shanghai. It was also discovered that approximately 10,000 Chinese troops, including units of the 87th, 88th and 36th Divisions and independent engineers were concentrated in the Soochow area ; 20,000, including special corps, engineers, artillerymen and cavalrymen, in Wusih ; 30,000, including units of the 27th and 33rd Divisions, in the Kiangyin area, near a strategically important section of the Yangtze River ; 6,000 troops of the 49th Division in the Wukiang area ; and 4,000 troops in the Changsha area—a total of 73,000. Early in August this number had swelled to an estimated number of 100,000, and this army began to advance under instructions from the Nanking Government in a converging movement toward the city.

All troop movements took place secretly and in all cases during night maneuvers. In the course of these "maneuvers" the soldiers would cast off their uniforms, slip into plain clothes and, after the exercises were over, remain at certain appointed places. Their arms and ammunition were usually concealed in the homes of wealthy Chinese civilians in the locality. It was easy to conceal arms and ammunition in this manner, but it was not easy—in fact it was impossible—to conceal the identity of the men. They did not speak the local dialect, and on every forehead was an identical tell-tale difference of color, lighter above the brows than the lower section of the face, a clear indication that the headgear they were accustomed to wear was—a soldier's cap.

Meeting of the Joint Commission

On June 8, just a month before the first clashes in north China, a special dispatch to the *Tokyo Nichi-Nichi* from its Shanghai office reported that the Chinese were planning to repair the Woosung Fortress, which was damaged by Japanese bombardments during the 1932 hostilities, and indicated that the information had emanated from sources close to the Shanghai-Woosung Garrison Headquarters (located in the demilitarized zone). Intending to repair the fortress to consolidate the foremost line of defence of the Yangtze Valley, the National Military Council of China, the report said, had purchased extremely delicate pieces of artillery from a foreign country and was planning to have a survey made by the garrison headquarters. The artillery arrived in Shanghai early in May, the dispatch indicated, and the Chinese were expected to approach the Japanese authorities on the matter, as the repair of the fortress was prohibited by the truce agreement.

The Japanese immediately asked for a meeting of the Joint Commission for enforcement of the truce agreement, composed of representatives of Japan, China, the United States, Great Britain, France and Italy, to call the attention of the Chinese and the interested Powers to the relationship between the truce provisions and the reported intention of the Chinese to repair the fortress. The commission met on June 23, but it failed to reach any definite decision regarding such concrete measures as conducting an investigation of the fortress on the spot.

Before the Joint Commission or Japan could take any further steps on the pending question, the north China hostilities broke out. The Chinese rushed their military preparations in and around Shanghai with increased vigor.

Investigations made by the Japanese, early in August, reveal that the disguised Chinese forces already in the demilitarized zone included 3,000 in the Public Safety Squad, a form of armed police; 2,000 camouflaged regulars concentrated in the area north of the North Station; 1,000 in the Kiangwanchen area around the City Government and Fuhtan University; 400, equipped with seven armored cars in Tachangchen; 1,000 in Litzuyuan; 1,000 in Kaochinmiao; 1,000 in Kotsaochen; and numerous squads of 50 in the neighborhood of the Hungjao airdrome and other places.

According to the same investigations, trenches and gun platforms had already been constructed at various strategic points, the first line linking the Jukong Wharf with Chun Kung Road, constructed with the object of defending the City Government and preventing the landing of Japanese troops; three lines radiating from the Far Eastern Stadium; five lines around Fuhtan University, one line in Kiangwanchen, and three lines in the area north of the North Station. These preparations increased conspicuously as the tension in Shanghai grew.

These military movements and preparations were not only a violation of the Sino-Japanese truce agreement, but a grave threat to the lives and property of Japanese nationals and to the safety of the International Settlement in which the Japanese reside with other foreign nationals and many Chinese. Japan's Naval Landing Party of 2,000 officers and marines, stationed in Shanghai for the same purpose as the forces of other Powers with major interests there, were enormously out-numbered. Being insufficient to cope with the situation which was developing in that city and sensing that the Chinese really meant to take drastic action, the Japanese Navy decided to strengthen its force in order to be prepared for any emergency.

Subsequent events, and in particular the stand taken by the Municipal Council of the International Settlement, were to show that the decision had been well called for.

Japanese Marines Murdered

Rapidly mounting tension in Shanghai, caused by the massing of huge forces and the erection of various military works by the Chinese around the Japanese sector of the Settlement, suddenly neared the breaking point on August 9, with the murder of Sub-Lieutenant Isao Ohyama, commander of the First Company of the Japanese Naval Landing Party, and First Class Seaman Yozo Saito by Chinese troops belonging to the Peace Preservation Corps. The incident took place at about 6.30 o'clock in the evening on Monument Road, while the naval officer, riding in an automobile driven by the seaman, was *en route* from the Landing Party's western outpost, of which he was commander, to headquarters, after inspecting the vicinity of the Japanese-managed cotton spinning mills.

The Chinese troops ordered the car to a halt and abruptly fired at the occupants point blank with rifles and machine-guns. The officer was killed instantly, and later an examination of his body revealed that he had been riddled with bullets. Seaman Saito also was killed outright by the first volley. Scores of rifle and machine-gun bullets penetrated the automobile. Gravity was attached to the killing, because both the officer and the seaman were in uniform and were attacked while performing official duties. The Chinese soldiers then mutilated the bodies of the victims. Ohyama was left beyond recognition. Eighteen injuries were inflicted on various parts of his body. His skull was cut asunder with a sword after he had died. A part of his intestines was laid bare and a hole large enough to admit a fist was dug at his heart. The Chinese soldiers took all the officer's belongings, including his sword, shoes, wristwatch and pocketbook.

Seaman Saito, after being dragged from the car, was struck in the face and head with rifle butts. All his possessions, too, were taken. His body was found where it had been thrown in a field some 400 yards south-east of the spot where the shooting took place.

The Chinese contended that the Japanese fired first and that they attempted to force their way into the Hungjao airdrome (about 300 yards from the scene of the murder). When the Japanese officials went to the spot early the following morning (after midnight) for inspection and to take over the body of the Japanese officer, the Chinese, pointing to the body of a Chinese soldier in a nearby bean field, advanced a counter-charge that the Japanese had made the first challenge. The Japanese, therefore, postponed taking over the officer's body until after a joint inquiry made later in the day which proved the Chinese charge to be false. The thorough investigation immediately instituted by a party of representatives of the Shanghai Municipal Council, the headquarters of the Shanghai-Woosung Garrison, the Peace Preservation Corps, the Shanghai City Government, the Japanese Consulate General, the office of the Japanese naval resident officer, and the Japanese Naval Landing Party definitely established certain facts which refuted the Chinese claims although, when the inquest started, the Chinese witnesses had been ordered away and could not be summoned.

An autopsy performed the following morning (August 11), on the body of the dead Chinese soldier in the presence of Japanese and Chinese officials with the participation of a neutral foreign observer definitely established that the Chinese contention concerning his death was entirely without foundation. The inquest disclosed that all the bullets that had hit him were from rifles or machine-guns. No trace could be found of a shot fired by a pistol, the only weapon that the Japanese officer could possibly have used. A bullet had passed from the back horizontally through the chest. Another bullet hit a bone and yet went through the body, indicating that it must have been discharged with more strength and speed than would have been possible with a pistol. The fatal bullet pierced the soldier from the right side of the back and passed through the left lung. On the basis of these findings it was concluded that it was a rifle bullet.

In spite of the extreme gravity of the incident, Japanese authorities in Shanghai, both consular and naval, immediately decided to exert every effort to reach a peaceful local settlement through diplomatic channels.

Indignation was voiced in both Japanese and Municipal Council quarters at the incident as the evidence definitely established that the attack on the Japanese naval officer and bluejacket had been made by men of the Peace Preservation Corps who, in violation of the international agreements, were occupying a road to which entry was forbidden. The outrage was all the more serious as the Japanese officer was killed while performing official duties and on a road along which all foreign nationals have the right to all the privileges they enjoy in the International Settlement. Moreover, the erection of barricades by the Chinese and the stopping and search of passers-by were an undue interference with the rights of foreign nationals.

On the morning after the incident, Japanese Consul General Suyemasa Okamoto called on Mr. Stirling Fessenden, Secretary-General of the Municipal Council, and expressed regret at the Council's inability to take effective steps to forestall untoward events of the previous night, despite the fact that Japanese authorities had previously warned the Council of the danger due to the military measures taken by the Chinese Peace Preservation Corps on the extra-Settlement road where the shooting occurred. In response, Mr. Fessenden voiced profound regret and pointed out that the Chinese authorities had deprived the Municipal Council by armed force of the right to guard a part of Hungjao and Monument roads.

Later, the same morning, the Secretary-General told newspapermen that the Council had claimed the right to guard the extra-Settlement roads with its own forces, but the Chinese authorities had so far failed to recognize the claim. He said that the Council was undertaking to guard some points along the roads on the basis of a gentlemen's agreement concluded orally with the Chinese. Unless the Council backed its contentions with armed force to counteract the Chinese stand, he stated, it would be obliged to give up all responsibility for defence of the roads. As a matter of fact, he added, the Council had already withdrawn its guard measures from Monument Road and other sections. The Council "can use persuasion to gain respect for neutrality, but has no power to enforce obedience," Mr. Fessenden remarked.

It can be seen from this that no positive measures were being taken to check the inroads of Chinese troops into the forbidden area. And even before the Ohyama incident, Japan was obliged to reinforce her small landing party in Shanghai, as the situation there warranted every precaution to safeguard Japanese lives and property which Chinese military activities seriously threatened.

Negotiations for Settlement

What did the Chinese authorities do to settle the incident? The National Government at Nanking, following a meeting of the Executive Yuan held on the day after the shooting, instructed Mayor O. K. Yui, of Greater Shanghai, to strive for a local settlement. Negotiations were opened on August 11, following completion of the inquiry into the slaying, when Consul General Okamoto called on Mayor Yui to submit an urgent request for amelioration of the threatening situation. He asked that the Chinese authorities withdraw the Peace Preservation Corps from districts bordering on those where Japanese reside and to remove the military works recently erected in the zone around the International Settlement which had been demilitarized by the 1932 truce agreement. Mayor Yui, as he had done days before, replied with assurances that the first request would be carried out and said that since the previous night (August 10) the Peace Preservation Corps forces had been forbidden to advance to the districts concerned. Assurance was also given that the Chinese had already, of their own volition, started to remove the hostile military works.

Contrary to these assurances the Chinese troops continued to push their warlike preparations, charging the situation with extreme tenseness and making a major outburst more than likely at any moment. The troops included picked units of various army corps of the Central Forces, estimated at that time to number about 12,000 in all, some of whom were incorporated into the Peace Preservation Corps. Not only were these hostile preparations dangerous to the Japanese population at which they were obviously aimed, but also to the safety of the whole international population living in the Settlement, as an attempt had been made by the Powers to prevent the outbreak of hostilities.

Suspicion that the Chinese authorities were planning to aggravate, instead of ameliorate, the situation soon found justification when it was discovered that sand bag and barbed wire barricades had been erected in the neighborhood of Monument Road, where the killing had occurred, and that men of the Peace Preservation Corps and policemen, armed with hand grenades, were stationed there.

The Ambassadors at Nanking of Great Britain, the United States, France, Germany and Italy sent a joint request, on August 11, to both Japan and China that the two countries do everything within their power to carry out effectively a plan to exclude Shanghai from the scope of any possible hostilities so as to safeguard the lives and property of foreigners residing there. The Japanese Government replied through Ambassador Shigeru Kawagoyé stating that while Japan was greatly concerned over the safety of the lives and property of all foreigners as well as the Japanese, China should, as the first prerequisite, withdraw to a point beyond striking distance her regular troops and the armed Peace Preservation Corps which were menacing the Japanese by advancing to their section of the Settlement. Japan assured the Powers that she would be prepared to restore her forces to their original positions provided China agreed to take the above steps. China, however, rejected the proposal and the Powers did nothing to press their joint request.

However, another effort was made to avoid a clash by calling together the Joint Commission for enforcement of the 1932 truce agreement. The Japanese Consul General made a pressing appeal to the Chinese that they withdraw their forces in accordance with the 1932 agreement. Mayor Yui, contrary to what he had assured Consul General Okamoto the day before, rejected the Japanese request saying that he had no power to accept and that the matter should be taken up with Nanking. The only result which could be obtained was a mutual pledge that neither side would begin to fire. With that the commission adjourned.

On the same afternoon, August 12, Japanese naval reinforcements landed in Shanghai to safeguard Japanese nationals residing in the International Settlement. The impression has been spread by erroneous news reports that these forces were sent because of the Ohyama incident and that Japan engaged the Chinese in open hostilities because of the outrage. The reinforcements were sent in view of the generally serious situation. Their arrival had no connection with the murder, but this incident showed that Japanese fears were well founded and that the landing of the reinforcements was timely.

Chinese Intensify Preparations

Taking the coming of Japanese reinforcements as a further excuse, the Chinese intensified their preparations on August 12. Military works were erected near Woosung and Kiangwan. Sand bags were piled high on roads leading into the International Settlement and in front of houses bordering on this neutral foreign area. Chapei, the scene of severe fighting in 1932, was again turned into one of the operating bases of the Chinese forces. The Japanese-owned Nomura Lumber Company, facing the Toyoda Spinning Mill across the Soochow Creek, was forced to suspend operations as a result of interference by the Peace Preservation Corps. At noon, the telephone communications of the Japanese resident officers, the Naval Landing Party headquarters, the Japanese Consulate General and Japanese firms and houses were stopped. Sergeant Ohmayé, of the Japanese Gendarmerie Corps, and his interpreter were kidnapped by the Peace Preservation Corps troops in the neighborhood of the North Station while on a tour of inspection in a motor-car.

About noon large units of the 88th Division of the Central Army which had been concentrated in Soochow entered the demilitarized area, alighted at the Shanghai North Station situated less than a hundred yards from the Settlement boundary, and immediately began to take up positions. It was learned that even prior to the first indications of trouble in Shanghai, they had been under standing orders to reach Shanghai in 24 hours. Encouraged by the arrival of these forces, Chinese troops around the Settlement adopted an increasingly provocative attitude, creating a tense atmosphere in which the storm was ready to burst at any moment. Hostilities were now unavoidable.

To cope with whatever situation which might arise, the headquarters of the Naval Landing Party announced at 8.00 o'clock that night that a unit of its forces had commenced to reinforce an emergency guard of the maintenance of security within the International Settlement against possible disturbances by Chinese troops already in the neighborhood. The Japanese Consulate General ordered immediate evacuation of all Japanese residing in the northern sector of the Settlement where the Chinese were coming in.

However, he still pursued his effort for a settlement on August 13, both with the Chinese Mayor and also with the foreign consuls. As a result of these consultations, the British, American and French Consuls General at Shanghai submitted a proposal that Japan and China enter into direct negotiations for the purpose of averting the impending crisis. This proposal was received in Tokyo at midnight. It was immediately studied. The next day Chinese planes bombed the Settlement.

Hostilities Commence

Ironically enough, the hostilities had began on Friday, the 13th. The first shots were fired shortly after 9.00 o'clock in the morning by Chinese soldiers in plain clothes. Issuing from hiding in private homes, they suddenly launched a surprise attack on a patrolling unit of the Japanese Landing Party near " Yokohama" Bridge on Szechuen Road. The pledge not to fire was broken. The Japanese took the challenge and the fighting began. Immediately after, spasmodic firing broke out in other sections, though the Japanese endeavored merely to silence the Chinese. In the evening, the Chinese blew up a bridge to the north of the Japanese Landing Party barracks. Neighboring troops, believing that it was an attack, opened fire with cannon on the Japanese, who replied and silenced them again.

The Chinese had decided to begin operations not only against the Japanese forces but against the Japanese section of the settlement. Mayor Yui notified all the foreign consuls, except the Japanese, that the Hongkew area would be bombarded and asked them to order their nationals to remove to the central part of the Settlement. This was on Friday, August 13.

August 14, the " Bloody Saturday," will long be remembered in Shanghai. On that day Chinese warplanes proved to the world what they can be at their worst. Hostilities had begun and the Chinese may have had good cause to use their warplanes to further their attacks against the Japanese. But they did not have the cause nor the reason to drop bombs on non-combatants, much less in the International Settlement and the French Concession, where thousands of nationals of neutral countries, civilian Japanese and swarms of Chinese refugees had sought the security which was supposed to be assured in these special areas.

Four huge bombers of the Chinese air squadron raided this area twice on the same day. They did not stop with the bombing of the *Izumo*, flagship of the Japanese fleet stationed at Shanghai, the Naval Landing Party and the Japanese Consulate General. Their lethal loads were dropped in the heart of the International Settlement and the French Concession. In one air raid, two high-explosive projectiles fell at the intersection of Nanking Road, the city's main artery, and the Bund, one blasting into the roadway almost at the main entrance of the famous Cathay Hotel, the other plunging through the roof of the Palace Hotel on the opposite side of the street. Both killed nearly 150 persons and wounded many more. This attack occurred at 4.27 o'clock in the afternoon. Again, at 5.00 o'clock, a single Chinese bomber dropped two missiles almost in the center of the circular intersection of Avenue Edward VII and Thibet Road in the French Concession, one of the metropolis' two busiest crossroads. The slaughter here was terrific. The bombs wrecked the front of the huge Great World amusement resort which, only the day before had been turned into a refugees' shelter and was packed with Chinese. The toll of dead and injured here was even greater than in the Nanking Road bombing.

When the count was taken the number of dead exceeded 1,200, including three Americans and a score of British, French and Russian nationals. Practically all of the victims were Chinese who had fled into the concessions which they had regarded as a haven of safety. The number injured was almost as great.

This tragic incident was enough to move Japan to positive action, for the protection of the Japanese nationals meant that of the International Settlement where they make their homes. Japan's original plans for defence as such had to be diverted into a strong positive defence—to drive back the Chinese forces to a point where they no longer would be a menace to the peace and security of the Settlement.

The Chinese claimed that the bombing was accidental. Though some doubt was expressed, their explanation was plausible. But the subsequent events made it less so and strengthened the doubt. On August 23, another bomb of Chinese origin struck the first story of the Sincere's Department Store and caved in the side of Wing On Store in Nanking Road. Caught in the hail of shell fragments, some 170 died and more than 470 were wounded. Still another bomb pierced three stories of the United States Naval godown in Szechuen Road, but luckily failed to explode. The Chinese declared that a missile from a "big naval gun" had done the damage. Officials of the International and French Municipal Council immediately made an investigation and established that the projectile was a Chinese one. A dispatch from the *New York Times*' Shanghai correspondent, mailed from Hongkong so as to escape alteration by the Chinese censors, gives the facts:

Hongkong, August 27.—That some international action should be agreed upon providing for armed measures or other restraints to prevent irresponsible Chinese aerial bombing and the killing of helpless civilians in Shanghai's International Settlement and the French Concession is the consensus of foreign consular, naval and military officials in Shanghai.

This opinion crystallized Monday, when another Chinese airplane, presumably one of those which an admiring Chinese public bought for Generalissimo Chiang Kai-shek's fiftieth birthday, smashed out nearly 200 lives and wounded or permanently maimed nearly 500 more persons.

Qualified foreign army and naval observers and precision instruments aboard American, British and French warships in the Whangpoo River disclose that the Japanese have kept their plege that their bombers will not fly over the Shanghai refugee area. The Chinese have refused to give a similar pledge.

Automatic registration on Monday showed that when the slaughter occurred a Chinese monoplane was flying over the city at an altitude of 12,000 feet. Moreover, the registration showed the plane was making a direct line from Pootung on the east nearly over the United States cruiser *Augusta* and the customs jetty, and then along a line where a huge bomb dropped in Szechuen Road without exploding and a second bomb, which hit the Sincere's Department Store on the Nanking Road corner, exploded.

One foreign Admiral's scornful comment was:

" The fliers are so badly trained as marksmen or so hysterical, excitable and irresponsible that they are like children playing with destructive weapons. In common decency they should not be entrusted with death-dealing airplanes."

Chinese censors struck the foregoing facts and opinions from cables and radio messages filed and even changed news cables to make it appear that doubt existed in the minds of foreign officials here that possibly the bombs came from Japanese planes, but this is distinctly not true.

The regular marines in Shanghai and the naval reinforcements not being sufficient for the purpose of driving back the Chinese, Japan sent land forces to strengthen her fighting position. These reinforcements landed at Shanghai on August 23.

The Neutral Zone Question

Shanghai having been transformed into a theater of hostilities, the Powers with large vested interests and nationals residing in the city naturally showed grave concern. Great Britain, through Mr. J. L. Dodds, Chargé d'Affaires in Tokyo, notified the Japanese Government on August 18, that if the governments of Japan and China agreed mutually to withdraw their forces and entrust to foreign authorities the protection of Japanese nationals in the International Settlement and on the extra-Settlement roads, the British Government was prepared to undertake the responsibility, provided that other Powers would co-operate. On the following day, the French Government notified Japan of its readiness to support the British proposal. The American Government had previously expressed the hope that hostilities in the Shanghai area be suspended in the interest of peace.

Under the prevailing conditions, Japan could not accept the proposal. Before the outbreak of the Shanghai hostilities the British, American, German, French and Italian Ambassadors in China jointly proposed amicable settlement of the Shanghai issue. To this Japan had given full consideration. But the Chinese failed to give any concrete manifestation of their intentions and became more positive in their attacks on the Japanese. Thus, one effort had failed. The British proposal, if tried, would, under the existing state of affairs, turn out to be as ineffective.

As was indicated in the Japanese reply to the British proposal, the " Japanese Government is responsible for the protection of its nationals in China," and therefore is in " no position to consider leaving the task of protecting them and the interests of Japan in China to foreign countries." The Government expressed the wish that the Powers which used their good offices in bringing about the negotiation of the 1932 truce agreement would utilize their influence with the Chinese to induce them to evacuate the troops which had entered the demilitarized zone illegally.

The Japanese population in Shanghai, swollen with refugees from inland cities, numbered well over 30,000. In order to protect these Japanese, including women and children, from death and destruction, it was obviously impossible for the Japanese naval forces to abandon their positions. No navy in the world would have consented to do so.

On August 16, when Chinese airplanes attempted to fly over the French Concession, the French garrison fired with anti-aircraft guns to drive them away. The position of the Japanese forces is exactly the same.

Going back a bit into history, on May 30, 1927, a violent anti-British demonstration occurred in the International Settlement. The Municipal Council took forceful measures to suppress that disturbance and nothing was said about the moral or legal responsibilities of the British in the matter. At that time Britain sent 15,000 men to protect its interests and the Settlement. This time it happens that a large force of Chinese regulars were attacking the Settlement with the Japanese as their objective. The two cases are the same, except, perhaps, in scope.

Precedents, however, do not mean anything. The fact of the matter is that those interested Powers who insist on the neutralization of Shanghai failed to give the necessary co-operation to avert hostilities. Japan was forced to play a lone game. Though the responsibility for the outbreak of hostilities in Shanghai lies at the door of China for ignoring the truce agreement and sending armed forces into the city, the authorities of the International Settlement and the various Powers concerned are partly to blame.

SUNGARI RIVER POWER.—A plan for generating 300,000 kw. of electric water power by utilizing the Sungari River has been drafted by the Manchuria Electric Company. At present the electric power supply of Manchoukuo is 300,000 kw., but the company intends to double it within the next 10 years. Its plans call for 240,000 kw. of hydro-electric power and 60,000 kw. of steam power to be produced by using inferior coal produced at Hsinchiu, near Fushun.

On the Eve of the Third Five-year Plan

By N. KOLTUNOV in the Economic Survey of the U.S.S.R. Chamber of Commerce

The second five-year plan has been fulfilled in four years and three months by industry and in under four years by the railways. In view of this, the government on April 28 last, adopted a decision charging the State Planning Commission of the U.S.S.R., the people's commissariats and governments of the respective Union republics to draft the plan of the national economy for the third five-year period and to submit same for the approval of the Council of People's Commissars not later than July 1, 1937.

The Soviet Union can look back with pride on the road it has covered in the second five-year plan period. This has been a road of uninterrupted progress, consolidation of the socialist edifice, vast technical re-equipment of the whole national economy and steady rise in the living standard of the population.

Two fundamental economic issues were placed before the country by the Seventeenth Communist Party Congress in the period of the second five-year plan — to complete the technical reconstruction of the national economy and raise the level of consumption of the population two-to three-fold.

With the fulfilment of the first and second five-year plans the country's technical backwardness has become a thing of the past. All the vital branches of the national economy have been modernized. This is most strikingly revealed in the remarkable progress achieved in the sphere of electrification and the extraordinary growth of the domestic engineering industry.

Consumption of electric power during the second five-year plan has increased three-fold since 1932. The U.S.S.R. holds third place in world consumption of electric power and the distance which separates it from the second place (and first place in Europe) is quickly narrowing. In some industries in the Soviet Union all the important technological processes have been electrified.

No less illustrative of the technical revolution which has been carried out in the Soviet Union is the progress of the Soviet engineering industry. The machine building and metal-working program for 1937 shows production to a value of 30.3 milliard roubles (at 1926/27 prices), whereas the figure for that year under the second five-year plan, as a whole, was estimated at 19.5 milliard roubles. Production figures of 1932 have been more than trebled and pre-revolution production has been exceeded more than 25-fold. Only recently the U.S.S.R. was a machinery and equipment importing country and to-day it is a machinery and equipment producing country. The U.S.S.R. in 1932 covered 11 per cent of its machine requirements by imports, whereas in 1935 these imports had fallen to merely one per cent.

By establishing an engineering industry of its own the Soviet Union was able to effect a complete transformation in the technical equipment of agriculture. Over half a million tractors, practically all of Soviet manufacture, are operating to-day on the Soviet fields. The output of tractors has reached a figure of 426,500 in 4¼ years, and will total about 500,000 in five years against 428,000 provided for under the second five-year plan. 100,000 harvester combines will be used in this year's harvesting campaign, of which 91,000 were produced in 4¼ years of the second five-year plan. Agriculture has been supplied with over three milliard roubles'-worth (at fixed 1926/27 prices) of various machinery, excluding tractors, during the second five-year plan period, which is 30 per cent more than the plan provided for. 350,000 lorries and 53,000 motor-cars have been turned out during 4¼ years, and the respective figures for five years will be 500,000 and 75,000. The year 1937 alone will see the production of 220,000 cars (including 195,000 lorries) against 200,000 (including 140,000 lorries) provided for under the second five-year plan.

Locomotives of the new *SO* make (Sergo Orjonikidze) were supplied to the railways. 441 of these locomotives were built since the end of 1935 and another 500 are scheduled for production in 1937. Since last year they are being fitted with tender-condensers, which are special devices for using waste steam. Locomotives of this type are capable of traversing enormous distances without replenishing water, which is a vital factor in some districts of Central Asia, etc. Moreover, they are of great importance to the railway system as a whole, since they considerably reduce stoppage time at railway stations and raise the commercial speed of train traffic. These engines can run at least 1,000 kilometers without taking on water. All the *SO* locomotives, to be built in 1937, will be fitted with tender-condensers as well as some of the *FD* (Felix Dzerjinsky) locomotives.

Two turbogenerators of 100,000 kw. capacity each are to be built for the first time this year. Each of these units will generate over a third of the electric current produced in the whole of tsarist Russia in 1913.

Rapid progress was made in the second five-year plan period in other industries as well. Pig iron production increased 2.6 times since 1932, steel output 3.4 times, ferrous rolled metals 3.5 times, quality steel nearly five times, phosphate fertilizers more than four times and so on.

The country has received numerous vast new undertakings such as the Chelyabinsk tractor works, the Ural and Kramatorsk heavy engineering works, the Kharkov turbogenerator works, the Moscow Metro — the finest underground railway in the world — the White Sea-Baltic and the Volga-Moscow canals and numerous other constructions.

The second five-year program for labor productivity has been completed in four years. Labor productivity in the whole five-year period will increase two-fold.

The other economic task of the second five-year plan — that of raising the standard of living of the population two to 2½ times, has also been fulfilled. The food industry has fulfilled the five-year plan in four years. The average wage has increased more than two-fold. With the steady fall in prices of general consumption wares the real value of wages is considerably enhanced. The retail trade volume of state and co-operative trading systems is scheduled to reach 131 milliard roubles in 1937 (against 80 milliard under the five-year plan estimate for that year), which is four times that of 1932.

The basic tasks of the second five-year plan have been carried out before time.

Technical backwardness has been conquered. Technically the U.S.S.R. to-day is one of the most advanced countries of the world.

The Third Five-year Plan will be called on to effect the complete electrification of all industrial processes capable of being transferred to electric drive. A decisive advance will be made in the electrification of agriculture. The Third Five-year Plan should see the completion of the largest high-voltage unified transmission system in the world and the commencement of construction of a unified high-voltage network throughout the European part of the Soviet Union. A number of important hydro-electric stations will be erected, including those at Uglich and Rybinsk, Gyumyush (Armenia) and others; the building of a huge hydraulic-engineering plant will be started in the Middle Volga with a generating capacity almost five times that of the Dnieproges (water power station on the Dnieper) which will carry out the important national work of irrigating the droughty lands on the left bank of the Volga and improving navigation on the Volga and will supply electric power to a huge industrial district (probably extending to Moscow in the west and to Ural in the east) and to hundreds of villages.

The Third Five-year Plan will see further great railway developments. New lines intersecting the country in all directions will be built and, together with the old ones, will be equipped with automatic block signalling; thousands of miles of railway will be electrified, trains will be drawn by electric locomotives, super *FD*, streamlined *IS* and tender-condenser *SO* locomotives, and so on.

The realization of these and various other problems will doubtlessly mean a great jump in labor productivity. The qualification of the worker who controls and operates complicated machinery, will be brought nearer to the level of the engineering staff.

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Future Work for the Engineer in China

By O. J. TODD, Secretary of the Association of Chinese and American Engineers

NO MATTER what is the final outcome of the present hostilities in China, this is certain—engineers will have real work to do. China will not go back to its former state of poor communications and inadequate control of rivers or of food production. More timber will be produced and greater efficiency will prevail in China's mining industry. Also hydro-electric possibilities will be explored and developed where found practicable. Surely the invasion of a mechanized army has already taught the advantages of modern equipment. This fact can no longer be neglected with impunity.

Roads

The mileage of new surfaced motor roads which have been built during the past four years under the general supervision of the National Economic Council is insignificant when compared with the needs of the whole country. It serves as an example of what should be done and aids a region in the Yangtze Valley that had no such roads before. These new roads have helped to connect large centers in China's southern provinces and particularly have linked up Shanghai and Nanking with provincial capitals that were previously much more difficult of access except by aeroplane. The newly dedicated road making it possible for motor-cars to go in a rather direct line from Nanking to Yunnanfu and then to Chungking, Chengtu and Sian was hailed as a great improvement in transport for China's "interior." Yet these roads serve as a mere skeleton of a system that must be so extended and so improved that the whole country will be well connected by similar or better trunk lines and feeders.

Troops moving in North China find few roads over which motor trucks may travel in rainy weather. Resort is had to horse- and mule-drawn small vehicles as in former days. The inadequacy of the road system in North China is most strikingly seen when large numbers of men start marching and have to bring their supplies close behind them. What is true of North China is true of North-west China and much of Central China. The good arteries of travel for wheeled vehicles are few indeed. This will be noted again and again in the coming months by all those on both sides who must be responsible for movements of long trains of wheeled vehicles. If this situation retards the invaders, it also handicaps the defenders. The cost and the loss of energy to more men and things from place to place is unduly high. These war losses are very apparent and make clear to all observers the similar loss that the country meets in times of peace.

So at the close of the present hostilities a broad road-building program is one of the things that will appeal to all leaders in government who hope to make of this country a new and better China. It will not be expensive when compared with the cost of the days of the present war which is estimated to cost the two sides $25,000,000 (Chinese currency) per day.

Railways

The railway service of China is highly inadequate as has been demonstrated in recent weeks. Certainly more double tracking and longer sidings are required if large transfers of men are to be effected promptly. Replacements of ties or sleepers and more careful ballasting are needs that appear to the non-technical eye. Such improvements are needed as will warrant considerable speeding up of the train service. The needs of a new China will make this compulsory. The railway bridges over the Yangtze and Han rivers at Hankow are urgently needed. Also the construction of a new Yellow River bridge for the Peiping-Hankow Railway should be a part of an immediate program of railway improvement.

The more rapid extension of the Lung-Hai Railway to both Lanchow and Chengtu and the completion of a standard gage line through Shansi from Tungkwan to Tatungfu should be urged. To bind Szechuen closer to Central China the line from Hankow to Chungking and on to Chengtu must be completed. Another line linking Changsha with Kweiyang and Yunnanfu is also necessary.

River Control

The control of China's great rivers has not gone forward on a large scale as, for example, has that of the Mississippi in recent years. The Yangtze, the Yellow and other troublesome rivers must be reckoned with in a large way. While studies of these larger rivers are not entirely complete, enough is now known about them to warrant the commencement of broad control programs that will mean expenditures of many millions of dollars every year for the next decade or two. This is work that the country cannot afford to postpone since China is an agricultural country and peasants must live on the bottom lands of the great river valleys. One major flood often costs China more than would an entire control program lasting many decades and costing upwards of $100,000,000. Probably the Yellow River comes first in need to be financed with the chief idea in mind being flood control. The Yangtze needs treatment both for the improvement of navigation and for flood control. The Fen Ho in Shansi requires extensive improvement for flood control on the Taiyuan Plain and water conservancy for increased irrigation.

Power Development

If suitable credit can be found then China should go into the development of hydro-electric power both on the Yangtze and the Yellow River. The former undertaking above Ichang will be far more expensive than a development on the Yellow River at Hu-K'ou Falls. In neither instance is there a large manufacturing center near by. These must be built up and connected with large centers of population by railways. A modernized China can use this power to advantage for it is assumed that industries will grow rapidly as China wakes up to the advantages of mechanization and sees that hand labor as practised in the past cannot alone sustain a great nation.

Irrigation

Though a start has been made in improved irrigation practice, particularly in the Sian district of Shensi as well as in Suiyuan, there is much more to be done in the latter province as well as elsewhere in China, including the provinces of Hopei, Shansi, Honan and Shantung, to speak of North China only. Though pumping has heretofore been considered rather expensive, if it means going from the old Persian wheel and chain pump, operated by a blind-folded donkey or cow, to centrifugal pumps propelled by steam or electric power, still the insurance of food supply in all provinces is essential and eventually the price must be paid for such insurance if it is at all reasonable in cost. This does not mean that in sparsely settled regions, such as Suiyuan, expensive power pumping should be installed before the demand for the use of the land warrants such expenditure, but at first a certain amount of hand pumping and hand bailing may be necessary as is practised in the more populous rice-growing regions of Hupeh and Hunan, for example. However with increased population and lower freight rates to good markets Suiyuan will gradually get to the point where it can afford large-scale pumping equipment. Meanwhile one of the cheapest developments is that of the Fen Ho in Shansi which should be carried out promptly after suspension of present hostilities. Shansi needs the food the extra water thus conserved will produce. In other places, also, a reasonable outlay of capital will yield fine results toward stablizing the food supply of North China.

Timber Production

Not alone as an aid in retarding erosion of her farm lands in the hilly North-west but also on the Great Plain of China the production of more and better timber is necessary. This question must be seriously considered by the State and, if practical, a subsidy paid to farmers for growing certain kinds of timber that are needed for buildings, for rough construction work, for parts of implements, etc. It may be that good railway-tie timber can be grown in China. Much of the pine used on construction of light railways in Shansi has been cut from the hills of that province. A better quality of timber and more of it is needed in China. But the pines that grow well both on Shansi hills and farther south should be protected and the area of pine forests increased. To protect and foster such forests must be a part of the development program of the New China.

Mines

Aside from the Kailan Mining Administration, which is the greatest coal producer of China, not much can be said for China's mining industry except that it is backward. It has not had proper financing and in all too large a proportion is primitive or semi-primitive. Too many coal mines are bankrupt or nearly so. The production and marketing of coal on a paying basis is a matter which should concern the State so keenly that a strong Bureau of Mines may be developed that will see that China's mineral deposits are worked to the best advantage of the country as a whole. It may even be necessary that the State acquire all mineral deposits, if it is not able to work at a fair method of subsidizing those mines that cannot be financed privately, so that they can be made productive in a way to pay for the working and still furnish the mine produce to the public at a reasonable cost.

Air Service

The use of aeroplanes in the present hostilities has demonstrated how much remains to be done before China can be considered up to date in the air. However, a good start has been made in recent years, and China can produce good commercial pilots. To greatly extend the present service and bring costs down so that a much larger percentage of the population can afford to travel by air is one of the tasks that confronts the engineers and financiers of the China of to-morrow.

Radio

Already China has begun the use of radio and to a degree every province has tasted some of its benefits, but this utility has not been enjoyed as yet by any great percentage of the people of this country. Here the Government can do much by expanding this service so that good broadcasting centers will be maintained in all the large cities of the country. Much can be done by using the radio to spread education over the many provinces of China. The dissemination of reliable news rather than propaganda should be the main aim of this service.

Housing

By no means the least service that will be demanded from the government in the new era which China is about to enter, will be village and city planning with suitable water supply, sewage disposal and sanitary housing. The old mud huts are not good enough and the squalor that has been too common in Chinese villages will have to be outlawed. Clean brick or stone masonry buildings suitably lighted must replace many of the unsanitary, dark dwellings of to-day. Here is real work for planning engineers.

More cement plants must be built and the cost of production so regulated that every village of consequence can afford substantial and clean habitations and places of business as well as public buildings. These structures should not be a monopoly of Shanghai, Canton, Tientsin and a few provincial capitals. The new China must be better housed in rural districts and in cities of moderate size. This means a tremendous program of town planning and rebuilding. When this is done China will rapidly go forward toward living standards more comparable with those of the West and the population problems will be almost automatically solved. In modern clean school buildings the children of the poorest families will learn something of better living and the old habits will drop away. China's present population of around 450,000,000 should not be increased, though it is said to be increasing at the rate of one per cent per year. The nation would be happier and stronger with only 250,000,000 people and the building of a great State with that number would be easier than with the present number 80 per cent greater. Likely the new way of living that must come will gradually bring down the population to a logical size. The introduction of machinery eliminating hand labor to a degree will prove a strong factor in this reduction.

Recreation Centers

Serious as the engineer's work is on the whole, his planning must include recreation centers. China needs great national parks and playgrounds as urgently as does America and Europe. Near the foot of Hua Shan in Shensi is a site for a wonderful health resort and amusement center. The climb up this old " holy mountain " is a real try-out for any man. This is one of the beauty spots of China. Wu Tai Shan in Shansi and the White Pine Forest region should be made into two national parks with good auto-road connections. The denuded hills back of the Eastern Tombs should again be forested, as should the region around the Ming Tombs. To blot out the marks of twentieth century vandalism much should be done in building up great playgrounds and protecting them as national parks.

In her principal cities China needs more good swimming pools of the grade built a few years ago in Chung Hai, Peiping, more baseball fields of ample size, more tennis courts and athletic fields. It is not enough that Nanking has a fine athletic field and stadium. A hundred other cities of China need similar facilities though on a somewhat lesser scale, perhaps. The coming China must advance the age at which children are set to work and find wholesome recreation and educational facilities for millions who now prematurely pull loads or work in factories. This belongs with and must be a part of any genuine reconstruction program for this country. To this work the engineering profession can well devote a reasonable share of its energies.

Looking forward fifty years one sees a strong China with many of the advantages the West now enjoys and still among its people the patience and the will to work that makes China so enduring. The engineering of all members of society has on his shoulders the greatest burden of all. He must effect these many changes and see to it that when peace comes money is raised through national or foreign loans, or both, to build China anew and make it a strong, self-reliant nation. China has in the making many engineers competent to play leading parts in this act and to these will be added foreign friends who can be drafted to aid in making the program a success in a broad way and in our time.

On the Eve of the Third Five-year Plan

(Continued from page 333)

The growing needs of the working people will be met at an increasing rate in the Third Five-year Plan. Agriculture will carry out the task set by Stalin to increase the harvest from 115 to 130 million tons a year. Light industry, thoroughly modernized, will be able quickly to increase its output and will become one of the country's advanced industries. The Third Five-year Plan will see the materialization of vast housing schemes and town planning. Per capita housing space in the towns will be increased and the largest cities in the country radically reconstructed. The plan for the reconstruction of Moscow, the Union's capital, will be carried out to a large extent. Other cities of the Soviet Union will receive hundreds of miles of tramway lines, bus and trolley-bus services, water mains and sewage systems. Hundreds of schools, hospitals, public baths and mechanical laundries, etc., will be built. The Third Five-year Plan will effect new and far-reaching socialist developments throughout the Soviet Union.

Japan's Overseas Electric Communications*

Their Development and the Present Situation

The proclamation of the Law authorizing the amendment of the Law Concerning the Organization of the Japan Wireless Telegraph Company, Limited, on April 2, 1937, has epoch-making significance with regard to Japan's policies toward overseas electric communications. The new Law was approved at the 70th session of the Imperial Diet.

In the present age of close international relations, electric communications—the telegraph, telephone, radio, and telephotograph—as *the international means of high speed communication*, function somewhat as the nervous system of the world. Being fully utilized throughout the entire range of military, diplomatic, commercial and social activities, they make life colorful, exciting and rich.

Among the many aspects of electric communications, those of diplomacy, commerce and dissemination of information are best known and most publicized. In the field of modern diplomacy, to begin with, the position of electric communication is all but absolute. Without international telegraphic and telephonic services no Government could continue, as is its custom, to carry on important communications with its overseas representatives.

In the field of commerce also, the activity of international trade is due, in no small degree, to the development of this phase of overseas communications. Rates of exchange, quotations for commodities and stocks in the principal markets of the world, and other basic matters with regard to industry, trade and finance are immediately reported and published in newspapers, creating waves of supply and demand which constitute modern world economy. International commerce is the leading customer of worldwide telecommunication services in respect to its volume of communications, inasmuch as it accounts for 80 per cent of the total number of foreign telegrams and 75 per cent of the total number of international telephonic messages. The amount of money paid for these services is by no means insignificant; it represents one per cent of the grand total of Japan's entire trade.

The *communication of information is of great importance*. Fresh and vivid information can be sent over seas and across continents within a few hours' time by means of press and radio news. Such activities in international information services, which prove to be an important factor in forming public opinion, in stimulating movements of world economy, and in directing international politics, depend entirely upon the function of the network of overseas electric communications. The fact that international relations are at present becoming increasingly closer connected makes this phase of telecommunication all the more essential as the means of transmitting information. The Powers, therefore, are consistently collecting information on the one hand and broadcasting their authentic news on the other, through their own overseas electric communication network. Likewise, Japan, in addition to transmitting thirty-one news broadcasts with a total of 8,000 words daily, is broadcasting over the radio news and music to all corners of the world as a daily overseas program.

The accomplishments of this phase of overseas communications are by no means confined to the external affairs of nations. To-day, their internal affairs, politics, industry, and culture, are not immune to international influences. The fact that the development of these phases of national life depends, in no small measure, upon the existence of a well-equipped network of overseas electric communications needs no explanation. The private and social life of individuals, which is keeping pace with other aspects of modern life *in matters of international communication*, may also be added to the list of the fields in which a means of high-speed communication is called for. The most vital one, however, is the use of this modern system of telecommunication in time of war as an important means of carrying out military operations, collecting information, and establishing connections.

Thus, international electric communication has come to constitute the backbone of international relations. In particular, in a country such as Japan, which is situated in a remote corner of East Asia, and from which oceans must be conquered in order to reach other countries, the place of overseas electric communications is of especial importance; measures for their promotion constitute to-day one of the most urgent national policies.

Development of Overseas Electric Communications and Submarine Cables

International telecommunication systems are classified, according to function, into the telegraph, telephone, telephotograph, and broadcasting wireless telephone, which is commonly called the radio; and, according to instrument, they are classified into the wire—submarine cable—and the wireless.

Historically, the submarine cable was the earliest system introduced into Japan. The introduction of the wireless telegraph was next in order, while the wireless telephone, telephotograph, and radio, by means of which direct communications between the Island Empire and the continents are effected, have been in service but these ten years, as they are products of modern wireless science.

The first introduction of the submarine cable into the world communication system dates from the year 1850, eighty-seven years ago, when Great Britain laid a cable across the English Channel connecting the British Isles with the European Continent. This was soon followed by the laying of cables across the Atlantic, Indian and Pacific Oceans, a development which is inseparably bound with the imperialistic expansion of the Western Powers, which took place in the 19th century in forms of acquisition of colonies, territorial aggression in the East, competition for supremacy over the seas, and other activities.

As the basis for carrying out her overseas policies, Great Britain first succeeded in spanning the Atlantic Ocean with long-distance cables in 1866, when the British Isles and the American continent were linked. At a later date cables were laid between England and Singapore via the Mediterranean Sea, then on to India. Great Britain thus ensured her hegemony in the realm of cable communications, which proved, as shown in history, a great advantage in her military, diplomatic and trading activities.

The United States, too, has long been operating her many cable lines to the European Continent, to the West Indies, and to South America, facilitating thereby the execution of her Pan-American policies. Furthermore, she extended her line, in 1903, to the Orient across the Pacific Ocean as the basic step in her Far Eastern approach. Accordingly, 87 per cent of world submarine cables, with a total mileage of 360,000, are to-day under British and American control, and all other Powers must depend upon those lines for their cable communications. It is no exaggeration to say that Anglo-Saxon supremacy in the modern world has been due, in large measure, to this wise and far-sighted communication policy.

Let us now turn to the process of development in Japan's foreign communications. We find that these began in 1871 with a cable service for which the Great Northern Telegraph Company had, in the previous year, obtained the right to land its cable at Nagasaki. During this period the same company constructed an aerial line from Northern Europe to Vladivostok via Siberia. Thereafter, for more than thirty years, telegraphic messages between Japan and other parts of the world were being exchanged through the Nagasaki-Vladivostok and Nagasaki-Shanghai lines of this company. True, these cable lines contributed, in no small measure, to the development of Japanese culture, but it was far from satisfactory that overseas telegraphic communications, which require speed, accuracy, and secrecy, should depend upon transmission lines in possession of a foreign concern.

In 1900, therefore, the Japanese Government, in co-operation with the American-owned Commercial Pacific Cable Company, laid a cable between Tokyo and Guam, which opened a new road for foreign communications through the trans-Pacific line of that company. This was the beginning of overseas connections in Japan's telecommunications by means of her own lines. It was, however, but an insignificant beginning in that Japan was in actual possession of no more than a cable between Tokyo and the Ogasawara Islands.* Dominated, as it was, by foreign interests, Japan was not in a position, in those days, to construct a great network of overseas communications, and had to be contented with a few short-distance cables under her control such as between Taihoku† and Foochow, Nagasaki and Shanghai, and Sasebo‡ and Tsingtao.

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*The Tokyo Gazette.

Emergence of Wireless Telegraphy and Establishment of Wireless Policy

As the national significance of submarine telegraph cables was widely realized, the Powers invariably became eager to hasten additional construction. They found, however, that this was an unfeasible task under the state of affairs which then prevailed, as a vast amount of capital was called for ; places to land the cables on the way were required, making likely the creation of intricate international problems ; and new lines had to compete with the existing lines, which was next to impossible. This situation, which seemed to ensure indefinitely the Anglo-Saxon supremacy over the cable communications of the world, was finally overcome through advancement in human intellect, which rendered possible the emergence of wireless telegraphy.

Wireless telegraphy for practical communication purposes was first devised in 1896, forty-one years ago, by Marchese Guglielmo Marconi, brilliant Italian inventor. It was, however, the World War that promoted its epoch-making growth. During the War, those belligerents which depended upon the cables of the other Powers for their communications, being subjected to relentless censorship of messages, felt keenly the necessity of finding means other than the cable for establishing autonomy in communications, thereby safeguarding information, propaganda, and strategic activities. Those in possession of their own cables, too, were anxious, to a similar extent, to find some such means, for their lines had frequently been severed. Under these circumstances it was but natural that wireless stations of sufficiently large scale to meet such requirements should be erected in various parts of the Western world. What accelerated this trend for the utilization of the wireless to the point of its competition with the cable has been the development of short-wave length wireless telegraphy, which is economical and, at the same time, efficient.

This phase of development in world wireless telegraphy has not left Japan as an exception. In 1916, wireless connection was made with the Hawaiian Islands by means of the Funabashi Station, which was operated under the supervision of the Navy Department. Then in 1911 the Iwaki Station was erected in Fukushima Prefecture§ with a view to improving communication with the American continent and to starting direct communications with Europe, the Asiatic continent and the South Sea islands. Yet this first step in the policy of establishing autonomy in overseas communications was not followed by consistent measures for achieving the purpose, due, in part, to the demand of an enormous amount for the construction fund, which cost characterized the long-wave length system that then prevailed, and, in part, to the financial limitations of the time.

Meanwhile, post-war expansion of wireless facilities was vigorously carried out by the Powers with the result that 111 out of the 134 wave lengths possible for use at that time were demanded by the five leading countries. If matters were to be left as they stood, the rights of use of electric waves were in danger of being usurped by Powers other than Japan. In the face of this predicament, the Japanese Government, in consideration of the conditions of public finance, resorted to the utilization of private capital for realizing its wireless policy. Accordingly, the Japan Wireless Telegraph Company, Limited, was established under a special law in 1925, for the purpose of constructing wireless telegraph plants to be used by the Government. Thus, Japan effected wireless connections with other parts of the world, realizing an independent overseas communication policy.

In 1928, direct communication service with America was opened, which was followed successively by the establishment of the station for the European service in Nagoya in 1929, and of the East Asiatic and South Sea services in Tokyo in 1931. Consequently, worldwide direct connections by wireless telegraphy have steadily been established, and Japan is now operating the following circuits :

With America (5 circuits) ..	the United States (2 circuits), Mexico, Brazil and Argentina.
With Europe (9 circuits) ..	Great Britain, France, Germany, Switzerland, Poland, Italy, the Netherlands, the Soviet Union, and Norway.
With East Asia and the South Seas (8 circuits) ..	the Philippines, the Netherland East Indies, India, Siam French Indo-China, Syria, Shanghai, and Tientsin.

To these, the Ochiishi¶-Petropavlovsk, Truk-Rabaul, Taihoku-Manila, and Taiwan-Hongkong connections (4 circuits) and the Japan-Manchoukuo connection (5 circuits), all of which use plants constructed by the Government, must be added in order to complete the list of circuits operated by Japan.

In fact, Japan's overseas wireless connections are maintained to-day by 31 circuits, making possible direct communication with all parts of the world, except Africa and Australasia.

A fact worthy of special mention in this connection is that the development of wireless communication in Japan, besides ensuring autonomy in her overseas communications, has, in a marked degree, decreased her payments with respect to international messages, contributing, to a considerable extent, to an improvement in her balance of international payments. This concomitant but no less significant result can be accounted for by the fact peculiar to the Japanese situation that in case of wireless messages only 50 per cent of the charges, instead of some 90 per cent as in the case of cable messages, has to be paid overseas, and that, in the former case, no overseas payment is necessary when the numbers of dispatches and receipts are the same. In the latter case, all messages to and from Japan must be paid abroad at the same rate. Since 55 per cent of her foreign telegrams are exchanged to-day by means of the wireless, Japan's overseas payments have naturally decreased considerably. However, on account of the loss from exchange Japan is still paying Y.11,000,000 in this respect. If the wireless is utilized to its fullest extent, she may recover far more in her overseas payments. Furthermore, since the increase in use of the wireless decreases overseas payments and the loss from exchange, such use enables the Government to lower charges for messages. The recent steps in the lowering of charges, which have been successively carried out, have been made possible simply on that account. It may be said, therefore, that the utilization of the wireless for all possible communication purposes not merely decreases the nation's overseas payments but also brings about the lowering of charges, both of the wireless and the cable, to the personal benefit of those who utilize both systems.

Development of the International Wireless Telephone

The international telephone actually used in communications abroad dates from the year 1927, just ten years ago. It was on January 17, of the same year, that the service between the United States and Great Britian was opened. In Japan a special company, The International Telephone Company, was established in December, 1932, for the purpose of constructing plants for the operation of wireless telephonic connections with overseas territories and with various parts of the world. Consequently, the service between Japan Proper and Formosa was opened in June, 1934, which was followed two months later by the Japan-Manchoukuo service. During the same year were effected connections with the Philippines, the Netherland Indies, and the United States and in the following year, those with Great Britain and Germany. Thus connections with 30,000,000 telephones in 41 countries, which represent approximately 90 per cent of the total number in the world, have now been completed, with the establishment of connections with Shanghai, Indo-China, Siam, and Argentina during the last two years.

The International Electric Communication Co., Ltd.

We have already noted that overseas electric communications in Japan, which lagged behind at the outset, have made amazing advances literally by leaps and bounds within the last ten years, in respect both to the telegraph and to the telephone. The present situation, in its scope and efficiency, is a new and significant development as compared with its insignificant form in the early days. Japan has now attained a position of world significance in the field of international communications. In view, however, of the complex international situation which prevails to-day, a development such as overseas communications, which constitute a vanguard of forces working for overseas expansion, cannot be permitted to remain static, in spite of its present progress and accomplishments. From the point of view either of the world-wide expansion of Japanese trade and culture or of the efficient dealing with foreign affairs and defence measures, it is a matter of paramount importance that telecommunication, in all its aspects, including the overseas telephone, telegraph, telephotograph, and radio broadcasting, should make further strides towards a new phase of progress.

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*A group of islands in the North Pacific, 529 miles south of Yokohama.

†A city in the island of Formosa, the seat of the Government-General of Taiwan.

‡A naval port in the island of Kyushu, not far from Nagasaki.

§A prefecture on the Pacific coast, situated to the north of Tokyo.

¶A town in the easterm corner of Hokkaido.

Under these circumstances, it has been found that for the two institutions relating to this important aspect of national policy, the Japan Wireless Telegraph Company, Limited, and the International Telephone Company, Limited, to operate side by side as separate bodies is not in keeping with the latest developments in wireless science, in which the technical adaptability between the telegraph and telephone has been established, or with the demand of the times which calls for the utilization for practical purposes of the international telephotograph, which is, technically, of an intermediary nature between the telegraph and telephone. In the light, furthermore, of the urgency of the synthesized development and operation of all the phases of overseas communications, it has been felt imperative that some definite steps should immediately be taken for coping with the situation. Such steps, however, for synthesized development and control would be inadequate if they were not carried out on a broader basis of the whole of electric communication, not excluding the cable, and on a stronger foundation with an increased capital fund.

The Government, therefore, worked out a measure for realizing a development, epoch-making in scope and appropriate under the existing state of affairs, of this important and latest phase of overseas communication, by establishing a so-called equipment-supplying company for all the types of overseas electric communication activities, including the cable, the telegraph, telephone, telephotograph, and radio broadcasting. As a result, steps were taken for the merging of the afore-mentioned two companies, forming a single corporation with the name International Electric Communication Company, Limited. For the same purpose the Law authorizing the amendment of the previous legislation pertaining to the Japan Wireless Telegraph Company, Limited, was approved at the 70th session of the Imperial Diet, and promulgated on April 2, 1937. Thus, the Law concerning the Organization of the Japan Wireless Telegraph Company, Limited, will be superseded by the Law Concerning the Organization of the International Electric Communication Company, Limited, making ready for the birth of the new concern.

At present, Japan's direct wireless connections extend in 31 directions by means of the wireless telegraph, and in 10 directions by means of the wireless telephone. In a few years, however, the plants of the new institution will enable her to increase connections in respect to the telegraph by 22 directions, and in respect to the telephone by 11 directions. Regular telephotograph services with East Asia and Europe will also be put into operation soon. The Japanese Empire will then, through a complete system of telecommunications, be placed in direct contact with all other parts of the world.

A Gleam of Light in the Dark

In the din of warfare when opposing forces are at each others' throats and the blasts of bombs, and shell-fire explosions benumb the senses of humankind, it is a welcome relief to become conscious of a kindlier, pleasanter note, a happy overtone in the general discord, that gives assurance that the whole balance of normal things is not yet overturned, and that mirth and laughter have not gone wholly out of modern life.

This gracious alleviation comes in the form of a little book of verse, *Ballads of the East* by a gifted writer whose works are little known because rarely published, and who has chosen to appear for this occasion as Shamus A'Rabbitt. The book has been published in Shanghai by Mr. A. R. Hager, a prominent American resident of the Port, who has been a resident of the Far East for many years.

The author has lived in China and Japan for more than three decades, and he has observed the colorful and varied panorama of Oriental life with keen understanding and ever kindly sympathy. Only at infrequent intervals through the years have bits of his verse appeared in print, formerly in the Hongkong newspapers and occasionally in other publications, under the pen name of John Kyoto. He has been known to a limited audience only because his writing has been done for the most part simply for his own amusement and that of his friends.

Shamus A'Rabbitt, whatever else he may be, is a poet philosopher, and, assuredly, he knows the East and the lives of those from overseas who have chosen to cast their lot in this part of the world. There is a glint of impish mischief, whimsical understanding and mellow wisdom in the lilt and flow of his lines. His writing is terse and full to the brim of the zest of living, and he has a singular genius for terseness, often presenting intricate thought forms in sparkling phrases, at times in single words.

Ballads of the East has been produced in extremely attractive form and the value of the slender volume is enhanced by striking illustrations and decorations made from artistic interpretive drawings of the celebrated Shanghai artist, Sapajou.

The publisher has had the forethought to present an edition of the book boxed most conveniently for mailing in the holiday season and a convenient novelty provided with the container is a detachable tag on which is printed postage rates and dates for mailing to various parts of the world.

The volume is on sale at booksellers at the price of $5.

Yangtze and Han River Valleys to be connected by Canal

The dredging of a canal linking the Yangtze River and the Han River, the two biggest waterways running parallel across Hupeh, at Shashih and Shayang in central Hupeh is being planned by the Hupeh Provincial Government.

Such a canal navigable to river steamboats, it is pointed out, will facilitate communication between the valleys of the Yangtze River and the Han River, especially with respect to easing the difficulties now being experienced in transporting goods between north Hupeh and Szechuen, Yunnan and Kweichow by way of the two rivers.

The decision to dredge the canal was made by the provincial government after an inspection trip to central Hupeh by Mr. Wu Ting-yang, Commissioner of Reconstruction of Hupeh, recently, when he was deeply impressed by the necessity of improving water communication between two big river valleys.

The Kianghan Engineering Bureau was entrusted with the responsibility of surveying the route of the new canal, which will most probably follow the course of a riverlet running from Shashih to Shayang via the Chang Hu Lake.

The section between Shashih and the Chang Hu Lake of this riverlet is navigable to junks for seven months of the year, while for the remaining five months it is navigable to small boats. The section between the Chang Hu Lake and Shayang is so shallow that it is navigable to only small boats.

More difficulty is added to transportation by this riverlet as its water level is much lower than the dykes protecting the Yangtze River and the Han River. Goods transported to the riversides have to be hauled over the dykes by human labor, which increases the freight rates to a considerable extent.

Moreover, the accumulation of silt in the riverlet threatens to ultimately paralyse navigation.

By turning the riverlet into a canal navigable to river steamboats throughout the year, communication between the Yangtze and Han valleys, the provincial authorities feel, will be much facilitated and goods from Szechuen, Yunnan and Kweichow can be easily transported to north Hupeh and vice versa by way of the rivers and the canal.

Mechanization in China

The Need for Government Supervision and the Possibilities of Insurance

By C. A. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Taikoo Professor of Engineering in the University of Hongkong

THE splendid efforts of reconstruction which the Central Government and many Provincial Governments in China are making requires expert advice for, and careful supervision of, much of the work in hand. The mechanization of industries which has taken place, and is developing rapidly in such cities as Shanghai, Tientsin and Hankow has, in many cases, taken place in a haphazard manner that has caused a terrible loss of life and costly damage to property. It is urgent that proper rules and regulations should be made and enforced by the Government in China to prevent similar, and even worse, occurrences in future.

These regulations should specify definitely the quality of materials used, and the qualifications demanded of those employed in design and maintenance of structures and machinery.

A Warning Several Years Ago

Soon after a visit to Canton in 1925, during which he had evidence of the poor quality of some engineering designs and materials in that city, the writer contributed an article to the *Far Eastern Review* in which he pleaded for Government supervision concerning the quality of materials used in engineering work in China. Unfortunately there has been very little progress to record, except the recent effort made by the Shanghai Municipal Council, which is discussed later in this contribution. The 1925 contribution to this journal proved, however, that other engineers in China had given much thought to this problem and agreed with the suggestions for reform.

In December, 1925, Professor John A. Ely, of St. John's University wrote to me very kindly commenting upon the article. He will, I feel sure, not object to a quotation from his letter. He wrote as follows :— "I want to say how glad I am that you have brought to a wide circle of the readers of the *Far Eastern Review* the necessity for the adequate testing of the materials used in the East."

Professor C. A. Middleton Smith, M.Sc., M.I.Mech.E., who has occupied the Taikoo Chair of Engineering in the University of Hongkong through 25 years

He also made a suggestion that there should be organized in China a Society for Testing Materials, a Society that would begin to do for the situation in the East what has been done so well by corresponding societies in Great Britain and in America.

It is of interest to remind readers that Professor J. H. Ehlers, who was at Peiyang University some years ago, was an enthusiastic advocate of this thesis. He resigned from his position at Peiyang in order to make an effort to induce the Chinese government to create a bureau which would have as its duty the establishment of tests and the collection of data that would gradually lead to the formation of definite standards for structural materials in use in China.

Incidentally it should be mentioned that some of the Provincial Governments in China have, in recent years, established bureaux for testing and grading certain articles of export and great benefits to the export trade have resulted. Similar arrangements are badly needed for testing certain imports to China. In every university in China there should be arrangements for official tests on materials.

A difficulty mentioned in 1925, by Professor Ely in connection with testing of materials in China, was the variation in the standards in use in different countries. There is now valuable international co-operation in this work, and standards for testing materials for all countries are becoming almost international, as far as differences in weights and measures will permit. In any case it should be easy for the Chinese Government to obtain practical advice from an International Committee of experts similar to that which did such splendid work in connection with recommendations for a general plan of development for the harbor in Shanghai. Their Report, issued in 1921, formed the basis of the remarkable work since carried out by the Whangpoo Conservancy Board.

The British Board of Trade

In Europe and America Governments insist upon certain tests on materials, and other precautions, to safeguard life and property. In Great Britain a Government Department, the Board of Trade, (B.O.T.), employ a large number of engineers and naval architects to carry out this work in connection with shipping. All vessels flying the British flag must satisfy the B.O.T., not only as to their sea-worthiness, and life-saving equipment for use in disasters at sea, but also concerning the design and materials of the hull and the machinery installed therein. These precautions are taken by the Government in Hongkong. It would be a simple matter to follow the example of the Hongkong Government ; the results have been, on the whole, most satisfactory.

There are also stringent rules and regulations regarding factories in Britain which are frequently visited by Government inspectors. There are in existence also a number of Boiler Insurance Companies who cover the liability of owners against loss of life and property. These Insurance Companies employ qualified inspectors who periodically satisfy themselves concerning the maintenace of boilers and, in many cases, of machinery insured.

Building Regulations

In all cities and towns in Britain the local authority imposes regulations concerning the design and construction of buildings, etc., erected in the locality. The time has come when Chinese Governments and Municipalities should seriously consider the enforcement of similar regulations to protect life and property ashore in this part of the world.

In Hongkong the local Government has assumed considerable responsibility not only concerning ships registered in the Colony, but it has enforced rules for the safety of local structures erected on land. Unfortunately records prove that however careful the supervision may be in any part of the world, disasters do take place. No country is free from these tragedies, however careful the authorities may be in their efforts for safety. But without such care the casualties are much more frequent.

During my residence of 25 years in Hongkong three major calamities, in two cases due to faults in the design of structures, and in one case caused by the poor quality of material, have taken place.

The first of these occurred about 20 years ago. Several hundreds of persons were burnt to death during the annual race week in the Happy Valley, owing to the sudden collapse of a three-storey matshed. There is no doubt in my own mind that the local

Public Works Department made a great mistake in granting permission for the erection of such a flimsy structure to be built of bamboo poles, etc., to carry a heavy load of hundreds of people. That mistake has never been repeated.

The second tragedy was recently referred to in this journal. It was the failure of the envelope of a large gas-holder that caused a terrible fire and resulted in many deaths and injuries. It was produced by forces unrealized before the tragedy. A result has been valuable researches which should ensure that no such calamity can take place again in any part of the world. The third tragedy recently took place and is described in detail below.

In addition to these major tragedies, casualties have been caused by the collapse of retaining walls, buildings and other structures. In some cases an official enquiry has shown that failure was due to torrential rains causing landslides, or to the collapse of a wooden beam weakened by white ants, etc. It is some consolation to know that the modern methods of construction of retaining walls, and of other structures, have enormously reduced the probability of such disasters.

In all cases of any such failures in Hongkong there is held an official enquiry. That is a most valuable method of obtaining information that is useful to engineers and architects. Subsequent investigations usually produce evidence that explains the cause of the disaster.

In Great Britain a number of insurance companies are at work, doing a good business, in order to protect owners of factories against loss of life and property. The inspectors of these companies frequently advise owners, not only to take precautions to avoid dangers, but to make changes that will increase the efficiency of their organization. Life insurance has, in recent years, made great progress amongst the Chinese. There is a great scope for industrial insurance in China and the Government should encourage it by legislation.

The Recent Tragedy in Hongkong

In May 1937 there was a terrible explosion of a launch boiler in the harbor of Hongkong. It caused 35 deaths and a large number of people were injured. A Coroner's inquest on a body was held and the jury made the following statements, recording their unanimous opinion as to the cause of the tragedy. It should be mentioned that, fortunately, the jury included an experienced professional engineer. Also reliable expert evidence, given by other qualified engineers, left no doubt in the minds of those capable of weighing evidence that the jury reached a correct solution of the problem. They stated :—

"We find that the cause of the explosion was the failure of the steel strip with which the boiler was repaired in 1924 . . . ."

"Whether the piece of steel forming the strip was or was not up to standard when it was first put in the boiler we cannot say ; but we are satisfied from the evidence that no boiler steel is now accepted unless it has been tested by the Board of Trade or has satisfied the tests of the Government Marine Surveyor's Department in Hongkong."

"We suggest that Government might consider the desirability of introducing legislation along the lines of the boiler explosion at 1882 ; *inter alia*, this would ensure that an inquiry similar to the present one would be undertaken by experts."

This last paragraph suggests that inquiries into similar disasters in Hongkong should be made, not only by a Coroner, but by experts who can value technicalities better than laymen who compose a jury. The Board of Trade conducts these inquiries in Britain and employs experts who issue a report, usually of great value to engineers. A similar system would be of service in China.

Defective Materials

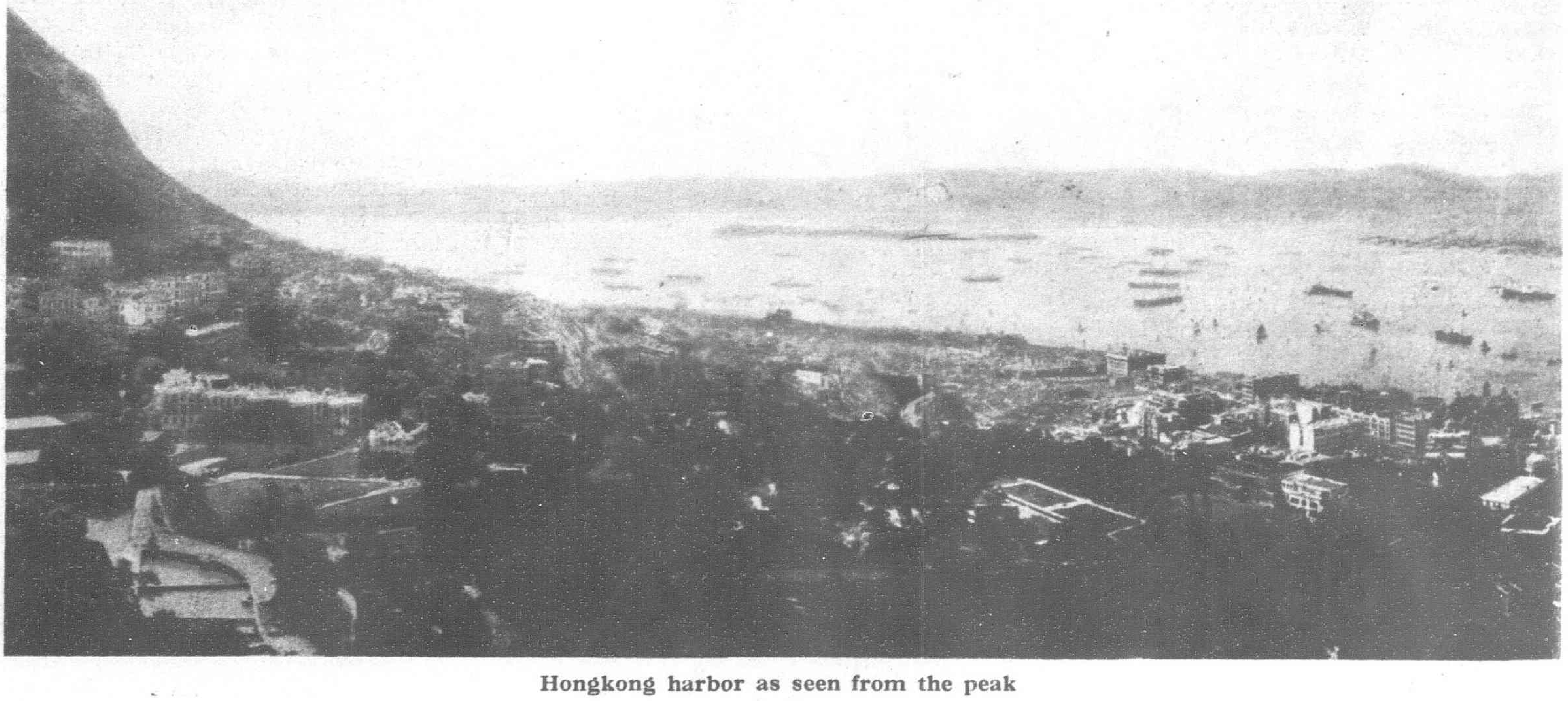
It is of interest to record that in summing up the evidence in connection with the boiler explosion in Hongkong the Coroner used the following words :

"There is, therefore, ample evidence that this strip steel was inferior. We learn that, before the increase of the Marine Surveyor staff in 1929, recognized steel-makers certificates were accepted for new strips, and B.O.T. certificates were not insisted on, but that since 1929 either they are produced or B.O.T. tests are applied locally."

From the above statement it will be seen that although the Hongkong Government had always taken considerable precautions to ensure safety on ships, launches, etc., in the past, they have made improvements concerning the supervision of materials used locally since 1929.

There remains a reasonable doubt about the quality of the steel used in the repair (1924) of the launch boiler that failed ; there was no evidence to show its history. That repair was made under the supervision of a Government Marine Surveyor. The boiler, at intervals since the repair, had been subjected to hydraulic pressures, considerably in excess of the working steam pressure. Whether the steel used for the repair was certified at the time as up to standard seems uncertain, but a careful examination of it, and tests made after the catastrophe, has made the writer form the opinion that, when used for the repair, it was not of the standard quality required for boiler plates. There is no record of any mechanical or chemical tests made on specimens cut from the plate in 1924 ; it is probable that if such tests had been made the plate would have been rejected.

It cannot be doubted that in China, a great deal of the steel, and other materials used, are below the standard demanded in other countries ; that is a most dangerous state of affairs ; every effort should be made to remedy it. The most reliable engineers in China are anxious that this matter should receive prompt attention.



Hongkong harbor as seen from the peak

As frequently happens, when there is a terrible disaster, there were current a number of rumors, of an alarming nature, concerning the cause of the launch boiler explosion, soon after it happened. Local newspapers recorded that people in the vicinity were convinced that a high explosive—" probably T.N.T."—had been the cause of the tragedy. It was stated that fumes that could only be produced by a high explosive were detected in the air immediately after the explosion. The noise of the explosion, and the position of some of the dead bodies, supported these rumors. Fortunately the official enquiry made it perfectly clear that the rumors were without any foundation of fact. There is now no doubt at all that the cause of the explosion was the defective material (mild steel), of which a portion of the boiler was constructed.

The steel strip used on the boiler that failed in Hongkong was jointed to the other steel plates of the boiler by what is known as a lap joint. A better practice is to use a butt joint for similar repair work, as with a butt joint there is then less probability that the material will become fatigued. That form of joint is now in common use, and should be made compulsory for repair work.

There is another suggestion that is worthy of consideration as it is the practice insisted upon by the boiler insurance companies in England. It is that the steam pressure allowed in any boiler should be reduced at certain periods as the material is likely to deteriorate in strength on account of the fatigue caused by the variation in the internal pressure of the boiler. That is a most important precaution and should be universally applied.

The Position in Shanghai

The not infrequent reports of many other boiler explosions, on the waterways, and ashore, in China, and the experience of qualified engineers, confirms the belief that an alarming proportion of the steel imported is of inferior quality.

A great deal of steel is used in China not only in the construction of vessels under pressure, but for reinforced concrete, nowadays a common form of building construction in all countries.

A letter from the Commissioner of Public Works, Shanghai, written in 1934, to the President of the Engineering Society of China was, it seems, the first official communication in this part of the world to draw the attention of engineers and the public to dangers in the Settlement that are very real and that demand safeguards. They exist all over China, and every effort should be made to reduce such dangers to life and property caused by the use of steel and other materials.

The Commissioner's letter mentioned that an alarming amount of defective steel was being imported to Shanghai and sold to engineers and architects for construction purposes. He emphasized that one of the main points to be considered was the menace to public safety.

Actual tests made in the Council's Testing Laboratory revealed **that more than 40 per cent of the steel reinforcing bars used in the Foreign Settlement in Shanghai failed to comply with the minimum ultimate strength requirement of any recognized authority in Europe, America or China.** That is a most alarming statement.

If that is a fact concerning Shanghai, where there are engineers and architects who value their reputation, and who are experienced and well trained, what happens in other parts of China ? We can imagine unscrupulous manufacturers in Europe and America, who have a quantity of steel that has been rejected as unfit for use in their own country, saying " Oh ! Send it out to China ; they won't worry about testing it out there."

The Commissioner of Public Works mentioned several points concerning steel used in China which, during more than twenty years, the writer has reiterated, time after time, in lectures and in contributions to the technical and lay press. Other engineers, jealous of their profession, have urged government and municipal supervision in China. It is astonishing that it was not until 1934 that the matter was officially mentioned in Shanghai.

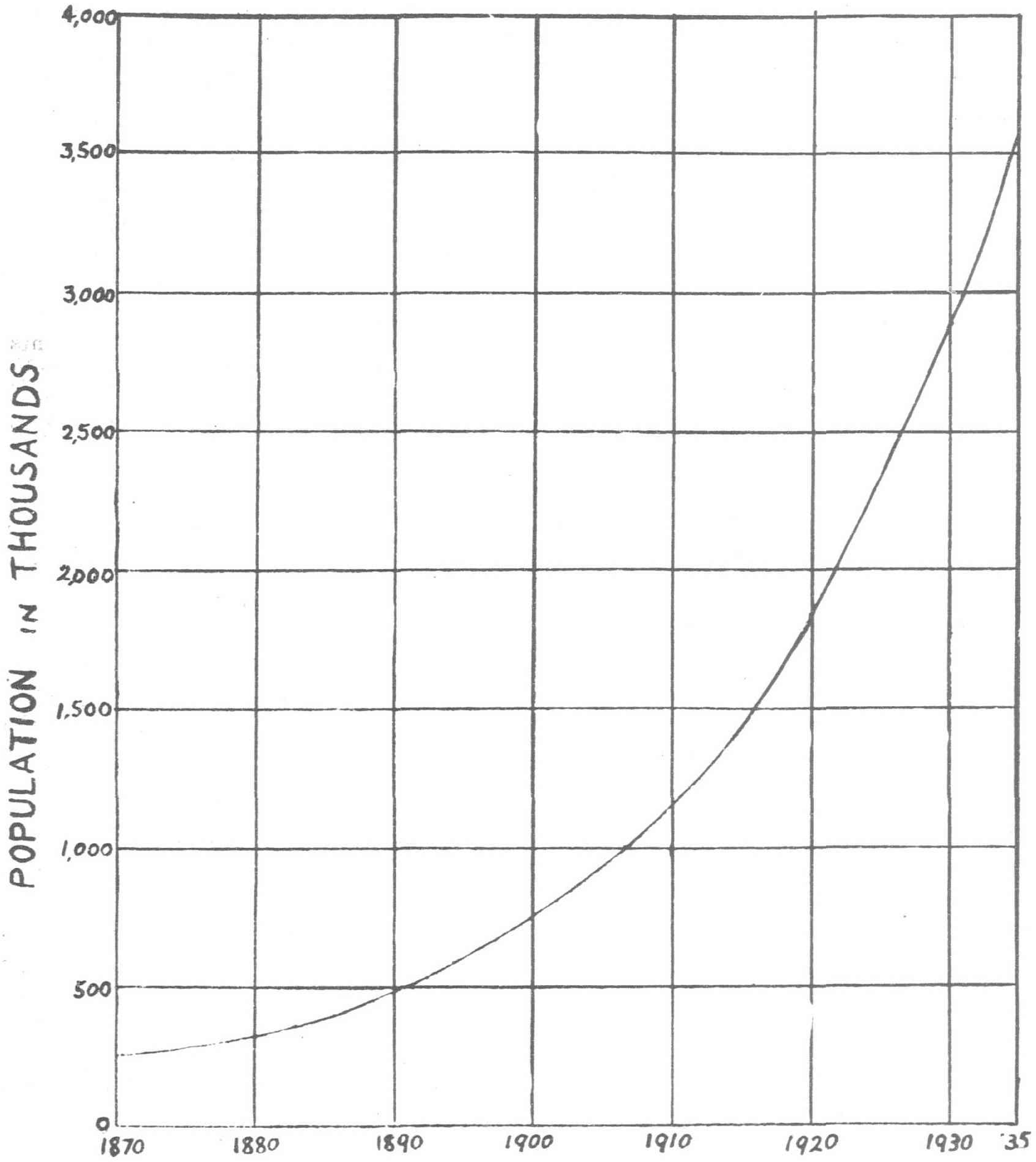
The S.M.C. Commissioner of Public Works, at that date, complained of " The practice of ordering steel on a price basis irrespective of its quality." That is a most serious reflection upon those architects and engineers who allow contractors to do this. It may be assumed that the best firms in Shanghai have always satisfied themselves concerning the good quality of steel used ; yet it is evident that a number of others have not done so. It was not compulsory to submit steel for tests in Shanghai when the statement quoted above was made, as far as is known to the writer. If that was the case what sort of steel was used is some of the structures ?

Data as to Quality Most Important

Incidentally it should be mentioned that in many cases it is false economy, and even dangerous, to purchase low priced material, or equipment, because a low price invariably means bad quality. Unfortunately Chinese purchasers will not realize that fact, and they have often been the victims of unscrupulous salesmen who have tempted them to buy inefficient materials or machinery by stressing the advantage of a low price. In engineering work it is almost always more economical and always safer, to obtain the best quality at the higher price. " Safety first " should be in the mind of every engineer and architect.

An example recently came to my notice. A large transport company in Hongkong tried out several types of high compression oil engines on their vehicles. These engines were supplied by various firms. There was a great difference in the price demanded by different makers, although the power developed by the engines was about the same with every make of engine.

Looking toward Kowloon



POPULATION of SHANGHAI (1870-1935)

The Chinese manager of the company was, however, determined to collect data concerning fuel consumption, cost of repairs, etc.; when he had obtained this data he decided to equip all of the vehicles with engines whose initial cost was 35 per cent higher than any other engines; it was about 100 per cent higher than the lowest priced engine; but he was not lured into trouble by the will-o-wisp of "cheap, price" for the engines.

It is to be hoped that other Chinese purchasers will follow this example and obtain definite data concerning performance and other properties of machines or materials. That data is of more vital importance than price. Many a scheme has failed in China due to false economy concerning price in the original purchase.

The Sea Walls That Failed

It is a tragic fact that large sums of money have been wasted on engineering work in China that have failed because of faults that could have been remedied.

In Amoy, a few years ago, a long sea wall was erected at a "cut" price. It was soon thrown into the sea by the force of the waves during a gale. The failure does not seem to have led to any official investigation. It may have been due to bad design, bad materials, or bad workmanship. Another sea wall, also at a "cut" price, was built and soon shared a similar fate. Finally a reliable firm of European engineers and contractors built a wall which has remained in place and can be relied upon for all time. That firm of contractors and engineers was available to build the original walls. But a cheap price on the two walls that failed more than doubled the total cost of the work. The unfortunate waste of money, caused by the disasters due to accepting a low-priced contract for the two walls that failed, should be sufficient example to warn people in China, if the facts are made widely known throughout the country. It is the duty of those who are aware of these facts to make them widely known; all true friends of China wish to see engineering schemes carried out efficiently.

If there had been proper Government rules and regulations concerning the erection of structures in Amoy that deplorable waste of money would not have occurred.

Unreliable Test Certificates

The Commissioner of Public Works, Shanghai, mentioned (1934) that there is often a lack of evidence to prove that test specimens submitted are representative of the steel used. Human nature is often weak; it is much less reliable than materials supplied by manufacturers with a good reputation. Deceit seems to be prevalent in many commercial circles, not only in China, but in practically every country. The careful engineer will trust no one; he should check the quality of all materials used in his work. It is imperative to be sure that steel used in structures is of the required quality. Reliable tests, made by reliable people, is the only method to ensure that good quality steel is used. That statement applies also to cement and concrete, materials now used in great quantities in reconstruction work in China.

It is apparent to any properly trained engineer that, unless the materials used in constructional work or machinery are reliable, grave dangers must exist, and one of the most urgent needs of the country in the registration of qualified engineers, with severe penalties for any lapse of professional conduct. That is a reform advocated by several Chinese engineers.

A word of praise must be given to Japanese engineers who have invariably receive a sound scientific training. Indeed, it can be said that, in some cases, they are so meticulous in their work that they insist upon precautions which some of us consider excessive. An example will illustrate this point.

As is well known an enormous amount of cement is manufactured by Japanese and is used in many parts of the Far East. Several years ago Japanese importers began to bring samples of cement to be tested in the University of Hongkong. Our experience in this work was of great interest to us; all of our relations with the Japanese concerned were very pleasant. We argued with them, however, about what tests were needed for cement. My impression was that some of the tests on cement which they demanded were superfluous. They submitted a specification concerning these tests which demanded much more work than the specifications in use in Britain and the U.S.A.

Standard Specifications

A Committee, consisting of representative of various Engineering Institutions, Government officials, and commercial interests in Britain has, since about 1900, issued a number of standard specifications for materials used by engineers. The value of the work of that Committee cannot be overestimated. It has led to standardization, itself a great aid to reduction in the cost of production. It has also eliminated the old, and often heated, technical arguments as to what is a desirable specification.

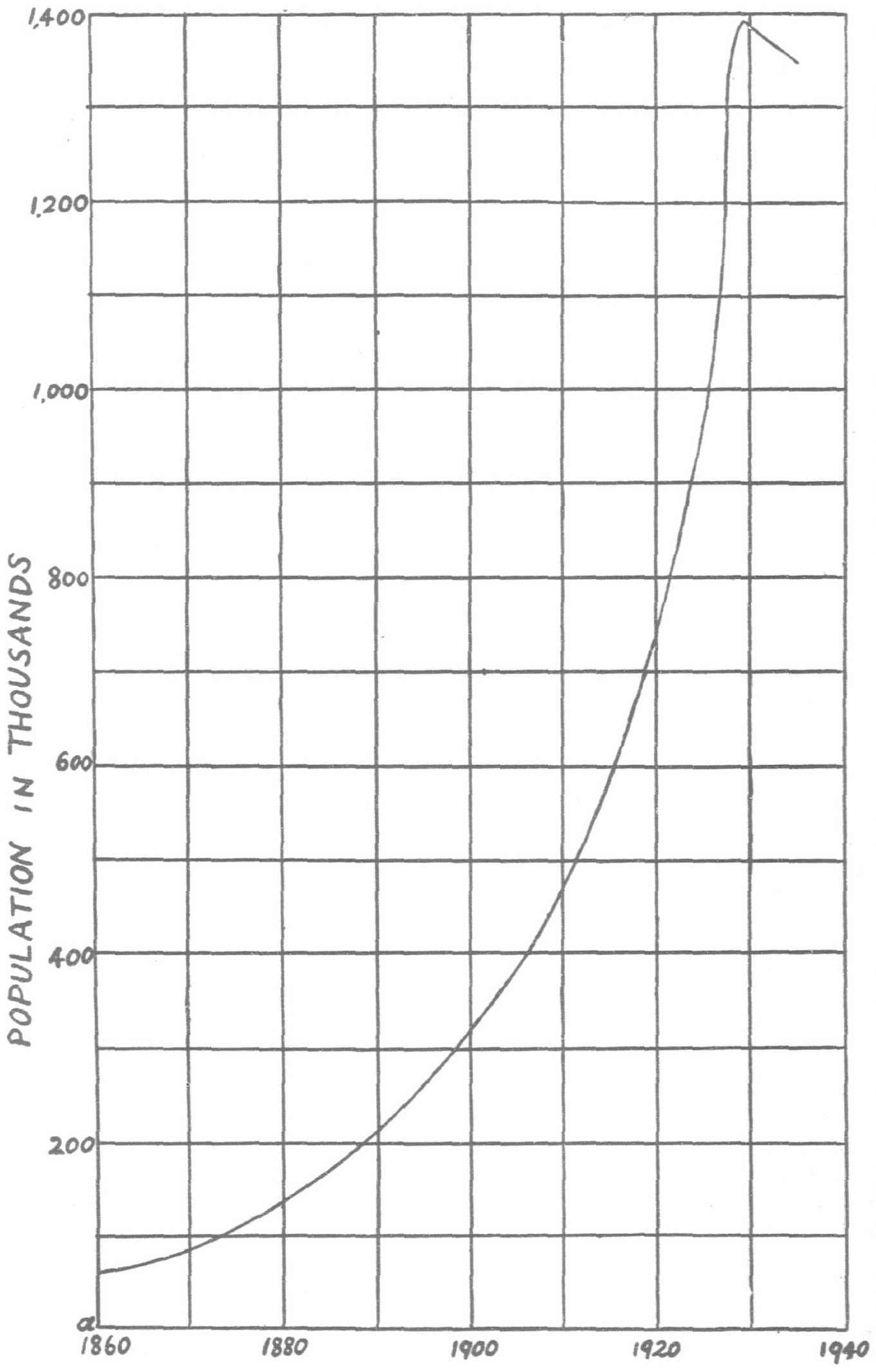
Standard specifications are used and appreciated by all engineers, and others concerned with industry in Britain, for they have, in practice, proved to be of great value to all concerned. Amongst those issued is one concerning cement. This contains details of a number of tests to be made on the material, and also data concerning the results of those tests which can be considered satisfactory, if the standards given are reached. Our practice in the University has always been to make cement and other tests according to the British Standard Specification.

The British were the pioneers in this work of preparing standard specifications. Their example was quickly followed in other industrial countries. All of these other specifications do not follow exactly those published in Britain. Amendments have been made to suit local conditions, and the views concerning technical details of those engaged in their preparation. There have been remarkable improvements made in the manufacture of cement, all over the world, and, in all countries amendments have been made in the standard specifications, from time to time, to meet the new conditions.

The standard specifications for cement prepared in Britain, The U.S.A., France and Germany have always included different methods to be employed in testing cement. In some cases entirely different methods were used to determine one of the many qualities of the material. For a large number of physical tests are made on cement which must not only be of certain tensile strength, but must comply with other requirements.

When we examined the Japanese specification, in those early days, we found that it included methods of testing suggested in practically all of these specifications; some we thought were unnecessary, as they were really in duplicate. Different methods were employed in the standard test used in Britain and the U.S.A. to determine a particular physical property of the material. It was, it seemed to us, unnecessary to employ two methods to determine one particular physical property of the material.

It is only fair to add that this excessive caution is far better than the haphazard methods so common in China. We have tested a large number of samples of Japanese cement and, as far as my memory is correct, none of them failed to reach the requirements of the British Standard Specification.



POPULATION OF TIENTSIN 1860-1935

The writer has had very little opportunity to test cement made in China, but all of the samples of material made in Hongkong have been satisfactory. It is to be hoped that reliable tests are frequently made on the cement manufactured in China.

Defective Steel in China

When we come to consider steel the results obtained during tests in Hongkong have not always been satisfactory. There are, however, elaborate local Building Rules and Regulations governing designs and materials used in buildings erected in the Colony.

Every new building, or alteration in a building, must have plans prepared by an architect authorized to practice by the Government. The plans must be submitted to, and approved by, the Building Authority, a sub-division of the Public Works Department.

The writer is convinced that, for safety, all steel used for reinforced concrete designs should reach the standard of quality demanded by the British Standard Specification. One requirement is that the material has an ultimate strength of between 28 and 32 tons per square inch. If the Building Authority in Hongkong is satisfied that the steel does reach that figure on test, then a working stress of 16,000 lb. per square inch is allowed in the design, which design must be approved by the Building Authority. If, however, the steel on test gives results between 24 and 28 tons per square inch ultimate strength, then a working stress of only 12,000 lb. per square inch is permitted.

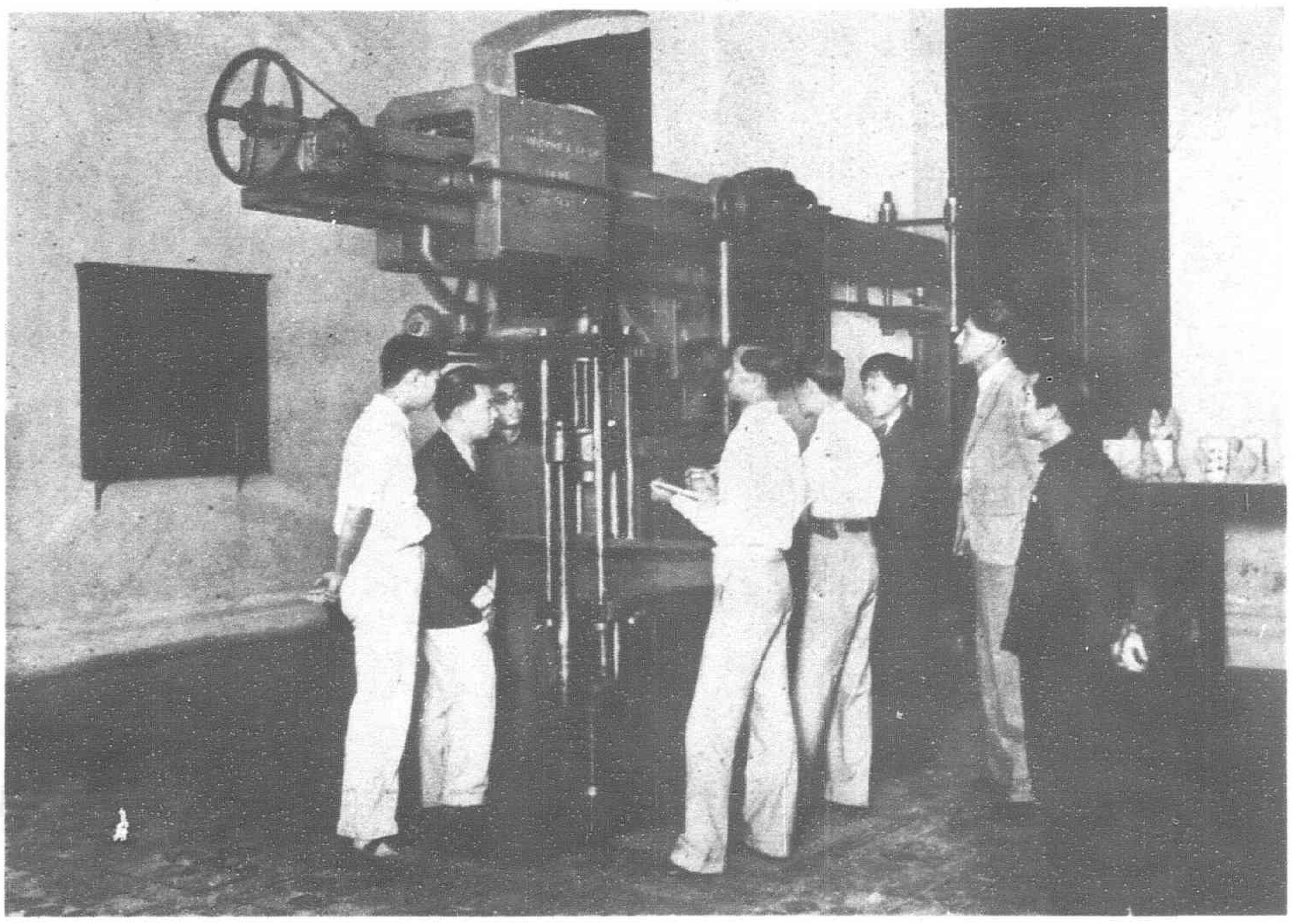
This seems a reasonable arrangement, and ensures a greater weight of steel to be used with the lower grade material. Unfortunately it overlooks the weakness of human nature. On more than one occasion there has been evidence that the contractor for a building has agreed to supply the higher grade steel but, without the knowledge of the supervising architect or the Building Authority, has attempted to substitute steel rods of the lower grade and cheaper material. Although there have been cases where the fraud was detected, it is not unlikely that in other cases the unscrupulous contractor "got away with it." If such a case is detected an example should be made by inflicting a severe penalty on the contractor. That has happened in Hongkong where the Building Authority has prosecuted contractors in the law courts. Reliable contractors, of course, will not run the risk of loss of reputation by a public prosecution. Publicity is a great incentive to honesty all over the world.

Difficulties of Supervision

It is of course extremely difficult to supervise completely the work of a contractor. If, however, the sort of thing mentioned above has taken place in Hongkong, where the local Government does its utmost to prevent such frauds, it requires no great imagination to come to the conclusion that, in China, where there is often very little supervision, by experienced engineers, and few penalties for failures of structures, defective materials are used. There is, indeed, any amount of evidence that such is the case. The frequent disasters due to bad quality of materials prove it.

Let me give another case from my own experience. A contract for a new building to contain a floor of reinforced concrete was let to a local Chinese contractor in Hongkong. This floor was designed to carry heavy machinery. The reinforcement was therefore vital for safety, and only the best material was specified.

When the steel for reinforcement was in position the writer carefully checked the position of the bars. That was mid-day on Saturday. He gave instructions that the concrete was to be run in on Monday morning, when he would watch the work being done, to satisfy himself that the correct quantity of cement would be used in the mixture. Less cement means weaker concrete and more profit for the contractor. On arrival at the building on Monday he saw that the steel bars had been covered with concrete, which must have been placed in position on Saturday afternoon, as it was already hard. He immediately instructed the contractor to remove the concrete; it took a week to convince that man that this order must be carried out. Meantime every day the concrete hardened. When at last it was chipped away from the steel bars it was apparent that at least 25 per cent of the bars had been removed. This resulted in much more than a 25 per cent reduction in the strength of floor, because the material had been removed in a haphazard manner. The gain to the contractor (if the fraud had not been discovered) would have been less than 100 dollars; but the result might easily have caused the death of several engineering students and others at work on the floor, for, it was practically certain to collapse when fully loaded because of defective construction.



Testing steel in the materials laboratory at the University of Hongkong

That experience has taught the writer to watch closely all work, including the mixing of concrete, done by contractors in the Far East.

Boiler Explosions in China

In recent years the newspapers have reported many boiler explosions in China. Recently there was a statement sent by a Canton Correspondent that a launch boiler on a vessel near that city exploded and caused a number of deaths. Shanghai has experienced many calamities, especially in recent years, due either to the defective design of boilers, the bad materials used, or the negligence of boiler attendants. On February 21, 1933, an explosion occurred in a rubber factory in the Eastern District. It was the origin of an intense fire and 81 people were killed. That is one of many tragedies caused by explosions in Shanghai.

An investigation made by several branches of the S.M. Council's service provided valuable information. Various suggestions were made in order to ensure greater safety in future.

A careful perusal of this Report issued by the S.M.C. created astonishment in the mind of the writer, who previously had imagined that the Council had exercised very much greater control and supervision over industrial establishments in the Settlement. Apparently there were no Council rules and regulations with respect to steam plant installations, and other systems under pressure in Shanghai, before this investigation took place, which was, after the explosion in 1933. That fact is a blot upon the escutcheon of the S.M.C. It was probably due, both to the ignorance of applied science on the part of those governing the Settlement, and to the neglect of advice given by local engineers. It seems to me imperative that any governing body of an industrial center, such as the S.M.C., should include amongst its members, not only men of commerce, but at least one man with a knowledge of applied science.

However, the Industrial Section of the S.M.C. made a survey of all factories in the Settlement as a result of the 1933 calamity. Interesting data provided by the survey included the statement that in 1935 there was a total number of 457 steam boilers in factories in the Settlement. During the ten years, 1920-1930, the number had about doubled. In the five years 1930-1935 the increase was even greater than that of the previous ten years. That is some indication of the rapidity with which mechanization is taking place in China.

It was discovered that 246 steam boilers were of local manufacture and it was a fair inference that they had been made by Chinese boiler makers using "Rule of Thumb" methods instead of the latest theory and practice available for boiler design and instruction. Such methods would not be tolerated in any country where the Government is concerned with safeguarding the lives and properties of those they govern.

A full account of the boiler situation in Shanghai and the regulations formulated by the S.M.C. was given in an admirable paper read before the Engineering Society of China by Mr. P. Taylor A.M.I.MECH.E. in Shanghai a few months ago. Some of the statements included in that paper are astounding and almost incredible. They must convince any engineer, or indeed any reasonable individual, of the urgent need for rules and regulations and much more careful supervision of all machinery used in industry in Shanghai, and in other cities in China.

The Problem of Mechanization in China

The disturbing thought arises that if this shocking state of affairs, revealed by Mr. Taylor, occurred in Shanghai as late as 1935 where there are many well qualified engineers, what must be happening in other parts of China? Mechanization is making very much more rapid progress in that country than is generally realized. Although there are several well-qualified Chinese engineers at work, yet most of them are civil engineers. With a few notable exceptions, nearly all Chinese mechanical and electrical engineers with University degrees have had very little practical training or experience. Every opportunity to obtain that experience under qualified engineers should be seized by ambitious Chinese mechanical or electrical engineers. There is a great demand for experienced and well qualified mechanical engineers in China.

However, conscientious engineers may be in their work, this defect of practical experience is a great source of danger to life and property in China.

Again there is a great peril due to the fact that very little effort has been made to provide a proper system of training for Chinese artisans. This class of worker has many admirable characteristics. He is industrious, cheerful, and usually interested in his work. Unfortunately it is perhaps the last mentioned characteristic that causes him to be very curious concerning mechanism about which he is entirely ignorant. In my own experience splendid Chinese mechanics have been the cause of a great deal of trouble because of their efforts "to find out how the wheels go round." They will attempt to remedy defects before reporting them to a qualified supervising engineer, and that often causes great damage to intricate mechanism.

On the right is shown the pier in the harbor of Hongkong where the launch was moored when its boiler exploded causing the deaths of 35 persons

Industry in Canton

In Canton the writer has visited industrial establishments which have alarmed him, because of the obvious dangers to life and property, due either to the arrangement or to the working of mechanical and electrical equipment. It is surely time that efforts should be made to convince the Central and Provincial Governments of the urgent need for the provision and enforcement of rules and regulation concerning industrial establishments in China. Whenever the subject has been discussed by the writer with his Chinese friends he has usually failed to arouse any enthusiasm for the above proposals. Life may be cheap in China, but it is sacred.

Faulty Installation, Neglect of Maintenance, and Inefficiency of Attendants

There are any number of illustrations provided by disasters in Shanghai to show that they have been caused, not only by bad materials, but by bad designs, bad installation, bad maintenance and incompetent attendants. All of these effects are explained at length in the paper referred to above.

Although Mr. Taylor considered only the boiler situation in Shanghai, and the commendable efforts recently made by the S.M.C. to remedy the old alarming state of affairs, it must be emphasized that there are many other aspects of industrialization in Shanghai and in China that demand urgent investigation. The S.M.C. are to be congratulated upon their recent efforts, but engineers and others who are aware of existing dangers must not remain satisfied with the S.M.C. reforms, but must continue to urge further reforms there and in industry all over China. A recent tragedy is worth mentioning. In May 1937 a deplorable accident occurred in the China Egg Producing Co., Shanghai, which resulted in the injury of 98 workers.

Deadly ammonia fumes leaked out of the refrigeration plant. Those at work in the factory, numbering about 200, were panic-stricken. A human stampede was the result. It appears that the main cause of the injury inflicted on the 98 workers was the inadequate number of emergency exits. The S.M.C. has a responsibility in this matter. There should be proper inspection at frequent intervals of all factories in Shanghai. It is encouraging to read in a Chinese publication, *The China Press Weekly* (May 30, 1937), the following statement.

"The accident in the China Egg Producing Co., and other industrial accidents, only serve to stress the need of an early enforcement of the Chinese Factory Law through competent inspectors under the auspices of the Chinese Government. The question is of such long standing that even a casual mention would seem to provoke a distaste. While theoretical discussions are proceeding off and on, more industrial workers have been added to the long list of the injured and the maimed. The public does not care about legal niceties; what it demands is action, and prompt action at that." Splendid! May other newspapers in China take up this important subject and advertise it.

Publicity and Justice

That brilliant English Consul, Meadows, one of the true friends of China who made a life study of the language, stated that in Chinese script the same character represents the English words "publicity" and "justice." That should encourage reformers in China to make use of the press.

In Hongkong there are a large number of comparatively small factories. Mechanization has not reached to anything like the total power used in Shanghai and Tientsin. The tariff wall in China acts unfavorably to mechanized industry in Hongkong. The total output of the electric power stations on the island and in Kowloon is but a fraction of that generated by the Shanghai Power Co.

The Hongkong Government has, however, inaugurated a system of factory inspection and it is the impression of the writer that conditions of workers in factories in Hongkong compare most favorably with conditions in other parts of the Far East.

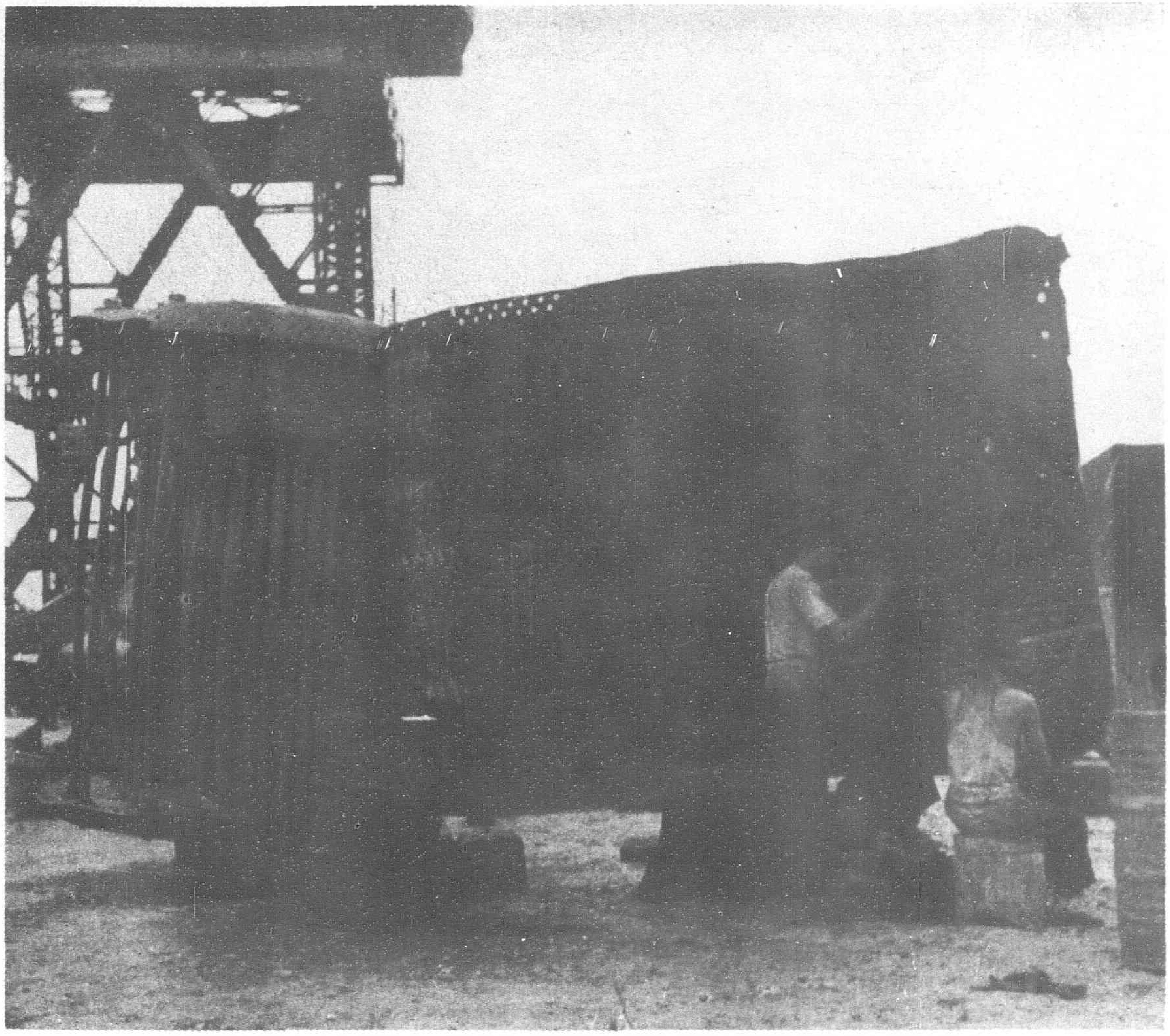
It seems to be a fact, however, that the local Government in Hongkong exercises no supervision over the construction and maintenance of land boilers. If such is the case the matter demands immediate attention.

Government Laws in China

The Chinese Government is to be commended for the efforts made to obtain the aid of the League of Nations experts to assist in the reconstruction of China. Dr. A. Stampar, of the Health Section of the League has been conducting investigations in industry in China. His report concerning some of the conditions which exist shows that they are appalling. In the leading tin producing district of Yunnan, the number of workers engaged varies from 50,000 to 100,000. About 50 per cent are children under 15 years of age. Of course small children in China are often compelled to work for the support of the family, but the conditions under which they have worked in these mines in Yunnan have produced an annual toll of 30 per cent. The temperature in the mines sometimes reaches as high as 120 degree F. In any underground workings the humidity is excessive; and humidity greatly weakens human resistance to disease. That is why the writer is enthusiastic concerning air-conditioning.

The Toll of Life in Industry

The workers in the tin mines in Yunnan received, for an annual employment of ten months, on the average, a total pay from $10



The launch boiler explosion in Hongkong harbor. The picture shows the salvaged boiler. The fracture of the steel plate can be seen at the extreme right

to $30. The mine owners (numbering some 700) in Yunnan make an annual profit of $300,000 each, as a reward for their terrible exploitation of the inarticulate children and other workers!

Dr. Stampar is of opinion that the evils in the mining industry in Yunnan are even worse than those produced by opium smoking. There is in existence a Mining Law of China with Rules for enforcement. If this were carried out properly the dreadful condition revealed by Dr. Stampar could not exist. It should be enforced with severe penalties for infringement. The matter is urgent.

This brings us back to the great need of educating public opinion in China. It is useless to formulate laws which are not enforced. In England a novelist, Charles Dickens, roused the social conscience of the country by his stories of the bad industrial conditions of a century ago. A large number of others, in all grades of society, have since worked for, and have obtained, reforms. In my own life-time there has been a great revolution in industry and in the conditions of life of the workers in factories and mines in Great Britain. There is no more urgent task for the reformer in China than the creation of public opinion that will insist upon improved conditions in industry in the country.

Humanitarian Work in China

The lectures and essays of Hu Shih, Lin Yu Tang, and others, emphasize that the five great national enemies of China are poverty, disease, ignorance, corruption and disorder. Hu Shih is a strenuous advocate of mechanization in China. He would, it is certain, lend the full weight of his influence in favor of reforms to safeguard industrial workers.

He is convinced that it is only through the utilization of the vast natural resources in China, by means of applied science, that poverty can be reduced. This is beginning to take place; greater progress has been made during the last ten years than in all the preceding centuries. But this progress demands increased attention to legislation that will safeguard the lives of those involved in reconstruction and industrial work.

Technological progress, by the control of the forces of Nature, has provided an immense increase in production, and an astonishing rise in the standard of living in many countries. It will improve the conditions of life in China if the work is carried out efficiently. There is, amongst engineers and doctors, perhaps more than amongst any other class of professional men, an awakened consciousness of the obligation to inform mankind how to obtain a more complete control over human destiny and evironment. That can only be accomplished through the intelligent application of scientific knowledge. The problems facing scientists in this age are largely outside of engineering in its narrow sense. They involve economic, political, and humanitarian aspects of life.

Some of the pioneers of engineering science realized that fact many years ago. If you study those now rather ancient writings of old Samuel Smiles, "The Lives of the Engineers," you will see that the vision of some of those men included a picture of the beneficient results to humanity of their work. As far back as 1880, Report H. Thurston, the first President of the American Society of Mechanical Engineers said, in his inaugural address:— "The Society will have much work to do as a Union of citizens having important interests confided to them, and its provinces will be no less in the field of social economy than in that which has reference only to the individual interests of its members."

There are many Chinese engineers to-day who realize those facts. They should be encouraged to make them known to the general public.

It is only by the use of extensive publicity that reforms can be obtained.

The New Social Conditions in China

Industrialization in China is taking place much more rapidly than the change in the social life of the people. That change in social life is essential to meet modern industrial conditions. Huge urban communities have suddenly sprung into being in Shanghai, Tientsin, Nanking and other cities in China. It is true that, so far as politics are concerned, there has been a rapid evolution from a concentration on the family life, to a consideration of national affairs. But there has been very little progress in creating a consideration for the well-being of others outside the family. The struggle for survival in China, for the majority of the people, makes it almost impossible for them to think of anything else but their own struggles for their own food and for the survival of their relatives. But the responsibility of those Chinese who are freed from the struggle for survival by the possession of wealth is very great. Unfortunately only a few show any signs of realizing this responsibility to their fellows.

It will need a great deal of hard work and propaganda to change the Chinese philosophy of life, with its emphasis on the duty to the family, in order to arouse that social conscience which is imperative for charitable work which is now so badly needed in the large urban communities created by modern industrial conditions. It is, however, encouraging to find prominent Government officials eager to introduce legislation to improve the conditions of those in poverty.

It is not easy for any of us to change our social habits. In the European communities in the Far East, in Europe and in North America, there are a very large number of people with big incomes who live an entirely selfish life, concerned only with their own pleasures, and negligent of the welfare of their less fortunate fellows. Yet it has been asserted that at no period in the history of the world has the social conscience been so active as is now the case in certain industrialized countries.

Flood Prevention Projects

In India and Egypt engineering works have increased the standard of life for millions of natives. The old foes of flood and famine have been defeated in those countries. Flood prevention projects in China demand the very best technical advice.

Twenty flood prevention projects costing $1,600,000 were carried out a few years ago along the Yangtze and Han Rivers. An increased value of $20,000,000 annually has been obtained in lands behind one dyke (Shih Show) since 1925. The new dyke did not fail during the unprecedented Yangtze floods of 1931. An engineering expert has written as follows :—

"The careful supervision by foreign engineers ensured a better quality of work than had previously been known." In other places "the people refused to follow instructions as to quality of work, size of section, height, etc. They insisted on a low factor of safety . . . . as a consequence high water, in 1933, demonstrated to these people and officials that it pays to follow the advice of experienced engineers."

In connection with flood prevention the Chinese nation owes a great debt of gratitude to an American engineer, Mayor O. J. Todd, for his long and gallant struggle to safeguard human lives and property against the dangers of flood in North China. Perhaps the greatest reward that has come to him is the knowledge that practical results have persuaded many able Chinese to concentrate on this work which is of enormous economic and humanitarian value. Mention should also be made of the very large number of contributions, containing valuable data concerning the rivers in North China, published by Mayor Todd and his associates.

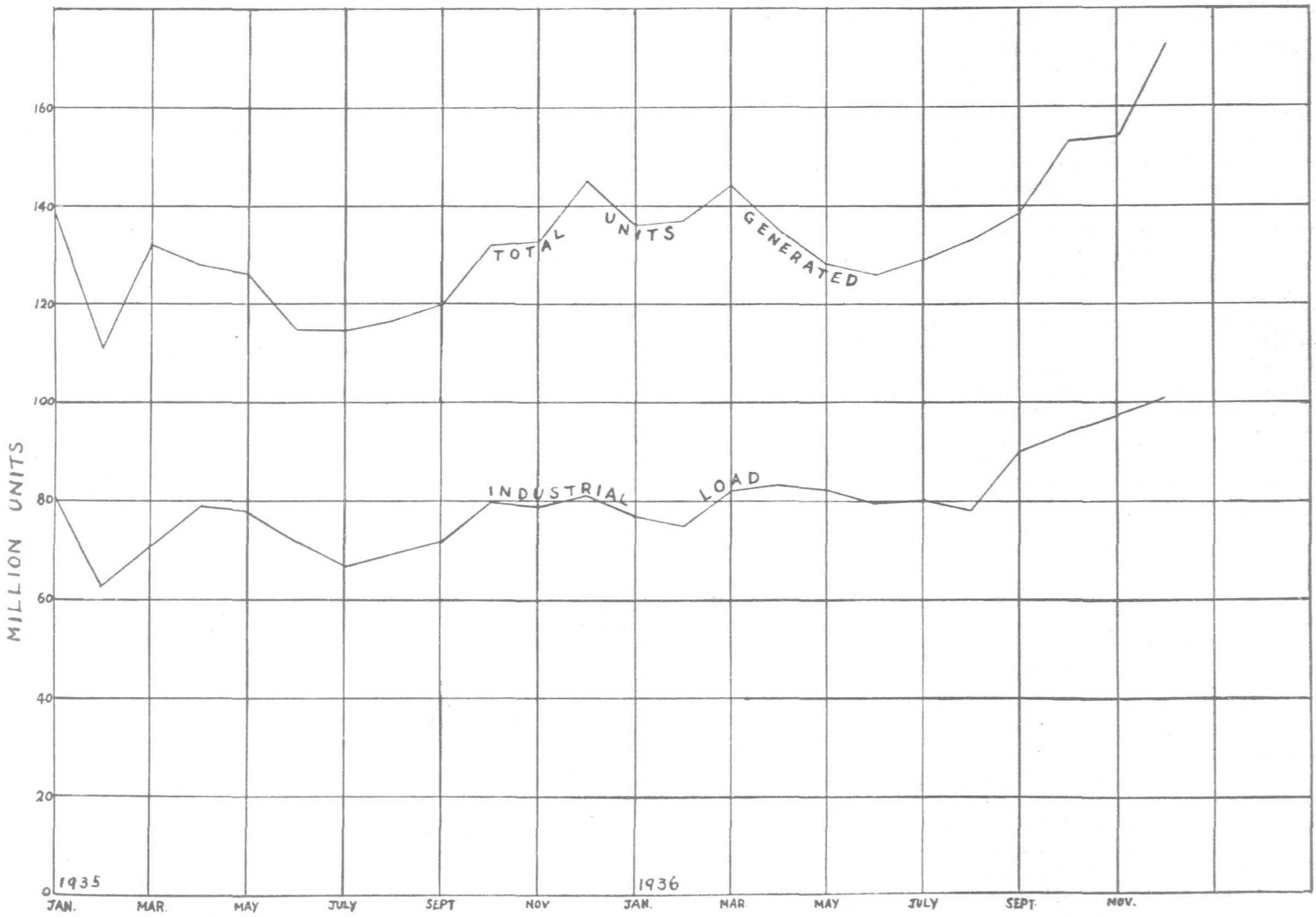
Expert Knowledge Imperative

The most important works connected with the development of the natural resources of many countries in Asia have been planned and supervised by foreigners. The economic development of Malaya, the astonishing transformation of Hongkong (from a pirates lair *into one of the largest ports in the world*), and the equally amazing evolution of Shanghai into the metropolis of China, have all been due to co-operation between Chinese and foreigners. The scientific knowledge and administration of foreigners has been a reinforcement for the industry of the Chinese. The knowledge of science and its practical application to local conditions, has been the main contribution made by foreigners to the welfare of China.

Japan eagerly sought for foreign advisers in connection with the economic transformation of that country. In China an outstanding example of the advantage of co-operation between Chinese and foreigners is the Maritime Customs Service, which has for many years provided a large proportion of the annual revenue for the Government.

Electricity in Shanghai

The rapid industrial progress in England, during the 18th and 19th century, was to a great extent due to knowledge gained from foreigners in previous years. The fact that ocean liners can reach Shanghai is due to the technical advice of foreigners in connection with the creation of a deep channel from the Pacific Ocean to Shanghai. The more closely the story of Shanghai is studied the more do remarkable unexpected details emerge. Shanghai factories have consumed more than 20,000 tons of coal a day. The output of electrical energy in Shanghai is far greater than that of Manchester or Birmingham in England. In 21 years (1915-36) the



Electric units generated in China showing industrial load annual output of the Shanghai Power Co. jumped five million units to 753 million units and it continues to increase. In addition to this supply, there are many other electric generating plants in Shanghai. In order to generate 753 million units the Shanghai Power Co. consumed 563,504 tons of coal. The cotton spinning and weaving mills consumed, in one year, more than 100,000 tons of coal, practically all of which was used for power production.

It is of immense interest to notice that the efficiency of many of these plants in Shanghai compares most favorably with best results obtained with plants of same size in Europe and America. It is due to the expert advice that has been provided by foreigners that this efficiency has been obtained. The population of Shanghai is 3¾ million and it seems certain that this must increase as industry developes in China.

Foreigners in China

China has benefitted enormously from the philanthropy of foreigners. Perhaps the most conspicious example is the outpourings of millions of pounds sterling into China by the Rockefeller Trustees. The splendid hospital in Peiping, the centers of medical work and research in other parts of China, have already saved numerous lives. Nor must the work of the International Red Cross in China, in its gigantic efforts to fight the dragons of flood and famine, be overlooked. The return, the gift, to China of Boxer Indemnity funds, for the benefit of the people is an act almost, if not quite without precedent, in world history and, whatever may be our views concerning religious propaganda in China, it cannot be doubted that large numbers of Chinese have benefitted from the money and self-sacrifice freely given by foreign religious workers to alleviate suffering through the provision of hospitals, medical centers and other charitable organizations.

Until this social conscience is thoroughly aroused in China there will be but little demand for rules and regulations to protect human life in industry. It is good to read of the great efforts made by the President and Madame Chiang Kai-shek and other prominent Chinese to improve the social conditions of the people. But the great need in China is to spread propaganda amongst all classes of people, but especially amongst the wealthy concerning this idea of social responsibility to their fellows.

Factors of Safety

In Hongkong we have had many soothing words on this subject; but, although in my time there has been an enormous increase in social work amongst the poor, a great deal of the organization, and a good proportion of the subscriptions, raised by residents for charities to benefit unfortunate Chinese, have been due to efforts made by Europeans. It is, however, encouraging to notice that much more interest in this work has been shown by local Chinese in recent years.

Those of us who are associated with mechanization in China have a very special social responsibility in this matter. We are aware of dangers concerning which other people are ignorant: we use "factors of safety" when we design structures and mechanism, but that is only one precaution to ensure safety of life and property.

The "factor of safety" is a form of insurance against unexpected overloads, and deterioration of materials, due to wear and tear. Careful supervision during construction, careful maintenance, and a careful selection of attendants in charge of any mechanism is also essential in China. Let us therefore urge, not only the application of modern scientific knowledge in China for the increase in total wealth, and individual health, in the country, but the enforcement of rules and regulations to safeguard the lives and the health of those affected by modern industry in China. In addition to ensuring safety of life, waste of human effort will be prevented by effective legislation. The elimination of waste is the aim of modern scientific research. The examples given above of waste of material and energy in China through lack of rules and regulations should convince the reader of the urgent need of a reform in connection with legislation for industry in China.

Science is the organized search for truth about the nature of things, which, when discovered, gives us control over those things. Science is power as well as truth. In the past man's worst enemy was Nature—famine, floods, pestilence, physical barriers such as mountains and uncharted seas. Nature is no longer formidable, for she has been subdued. Our present troubles are due, not to nature, but to man in the mass. Millions are hungry, but wheat is thrown into the sea. Millions need clothing, and cotton is burned. Under modern industrial methods the world is a single economic unit. Civil war in China brings destitution to Lancashire and affects factories in America dependent on raw materials exported from China.

All over the world science is transforming social life, making new forms of society and demanding new qualities in eminent citizens. The rapid growth in population in the cities of China and the mechanization of industry presents difficult problems for China's rulers, but they should not be neglected. It is only by constant agitation and statements of certified facts that we shall obtain the enforcement of proper official rules and regulations to safeguard the lives of those engaged in industry in China.

Developing New Oil Regions in U.S.S.R.

In a statement recently published in a Moscow newspaper, Mr. A. Krems, chief geologist of the Central Administration of the Soviet oil industry, said that 14 new oil-bearing regions would be developed in the Soviet Union this year and that prospecting work would be carried out in another 20 new regions.

In the course of his remarks he says: "There is every proof that the oil layers of the Apsheron Peninsula, the Grozny and Mailkop fields in the Caucasus, where oil has been extracted for many years, still contain considerable supplies. Last year Pirsagat, a new district lying to the south of Baku, yielded oil on an industrial scale for the first time. We are following up this oil-bearing formation and are drilling in the Alyatsk District south of Pirsagat. In the Grozny District we are concentrating our prospecting work on the eastern section of the Terek Mountain Range. Oil has already been struck there in two places and further experimental drilling will undoubtedly prove that the Terek Mountains contain rich deposits of oil.

"We are also devoting much attention to obtaining oil from the bed of the Caspian, and are planning to drill for oil beneath the sea both in the region of the Apsheron Peninsula, near Baku, and in the district of Izberbash in Daghestan, where the first wells tapping the sea bed were put into operation last year.

"Prospecting in the region of Maikop and in the Kuban is expected to reveal an unbroken layer of oil-bearing formation from Apsheron to the Kuban deposits in the North Caucasus, where the Kesterovo oilfields are ready for exploitation. In this region, too, the Adagum strata is to be prospected, preparatory to transforming the Kuban into a new oil-producing center. This unbroken line of oil-bearing formation reaches as far as the Crimea, where, this year, the new districts of Cho-Relek and Chon-Gelek are to be drilled.

"In the east of the European part of the U.S.S.R. "wildcat" drilling will be carried out on a large scale in the Kuibyshev (Samara) bend of the Volga, where we are planning to prove the oil-bearing properties of the entire region of the Zhigulev dislocation, and also along the northern section of the Kama River. We already know that oil exists throughout the whole of the vast territory lying between the Volga and the Ural mountains. This year we are planning to prospect the northern zone from Krasnokamsk to Kirov (formerly Viatka).

"Prospecting in Central Asia is expected to reveal an unbroken oil-bearing zone extending 100 kilometers along the Surkhan-Darya River, a tributary of the Amu-Darya in South Uzbekistan. Prospecting for oil is also proceeding in Turkmenia, to the south-east of Neftedag, as well as in a number of entirely new districts, which are being included in the orbit of the Soviet oil industry for the first time. In Bashkiria we are planning to investigate districts adjoining regions already under exploitation to find out whether they contain oil on an industrial scale.

"Drilling will also be carried out in the Romna district of the Ukraine, 140 kilometers to the east of Kiev, where traces of oil have been discovered. Geological prospecting, but without deep drilling, will also be carried out in the Moscow Province, in the southern part of the Northern Province, on the eastern slopes of the Urals as far as Kazakhstan and the Far East. In addition, the Northern Sea Route Administration is prospecting for oil in several places beyond the Arctic circle."

The Ports of the Straits Settlements*

By SIR GEORGE TRIMMER, Chairman, Harbor Boards, Straits Settlements

MALAYA has three ocean ports, Singapore, Penang and Port Swettenham. Singapore and Penang serve important markets for local produce and minerals, and by reason of their geographical positions at the southern and northern ends of the Straits of Malacca handle a large transhipment trade.

Port Swettenham, which is a railway port, owned and administered by the Federated Malay States Railways, handles a considerable tonnage of coastal traffic for Singapore and Penang, while providing a few berths for ocean-going ships.

The port facilities of Singapore were developed, in the first instance, by private enterprise; but in 1905 the Government of the Straits Settlements expropriated the wharves and dry-docks, then owned by the Tanjong Pagar Dock Company, Limited. The management of the undertaking was vested in a board, the members of which were nominated by the Governor of the Straits Settlements. This board, known as the Tanjong Pagar Dock Board, ceased to function in 1913, being replaced by the present Singapore Harbor Board.

The port facilities of Penang, however, were from the outset developed by the Government. In 1908 the management was handed over to the Penang Committee of the Tanjong Pagar Dock Board, the present Penang Harbor Board also being formed in 1913.

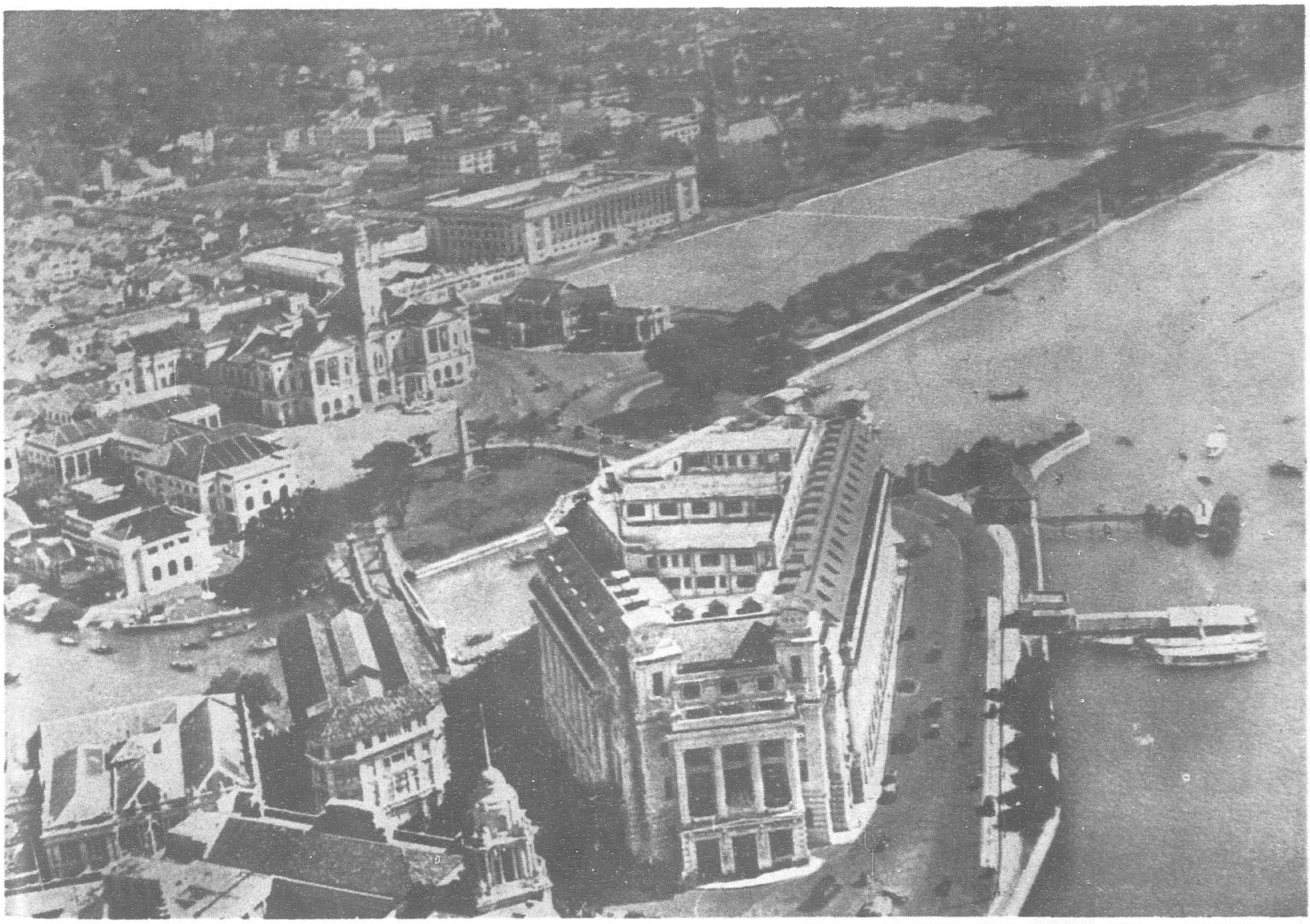
The members of the Singapore and Penang Harbor Boards (there being at present eight members for Singapore and four for Penang) are appointed by the Governor of the Straits Settlements and administer the facilities in each port under the chairman, Harbor Boards, Straits Settlements, with a local chairman for each board.

Both boards are run on financially autonomous lines, paying full interest and sinking fund charges to the Government in respect to all loans raised or moneys lent by the Government for developing the facilities of either port.

The Singapore Harbor Board

Thirty years ago the port facilities of Singapore were in a parlous state. The Boxer rebellion had brought warships and troopers from every nation in Europe to the Far East, and the organization of the Tanjong Pagar Dock Company, Limited, had broken down completely under the strain of congested wharves, warehouses and roads. The directors of this company had vacillated for several years between proposals to extend the wharves or to build a new wet dock, and it was not until 1904 that a concrete scheme for placing the undertaking on a proper footing was prepared.

In that year, however, the Colonial Office, which had for long realized the importance of the port of Singapore to Imperial trade, decided to expropriate the concern. The Government of the Straits Settlements took possession of the undertaking in 1905, and the newly formed Tanjong Pagar Dock Board, under the chairmanship of Sir John Nicholson, C.M.G., immediately set about the task



Photograph by Gordon Burt, A.M.I.E., Editor and Publisher, The Journal of Engineering Association of Malaya

Singapore

**Malayan Supplement of the Financial Times* of building a new wet dock, now known as the Empire Dock; reconstructing the existing wooden wharves by permanent concrete blockwork wharves; and building a large graving dock, the King's Dock, capable of accommodating any vessel afloat or contemplated at that period.

Mainly to finance the purchase of the company's assets, valued by the Court of Arbitration, which sat in Singapore in 1905, at nearly $30,000,000, and to carry out this large scheme of reconstruction, the Government of the Straits Settlements raised the 3½ per cent. S.S. Inscribed Stock 1937-67 Loan, amounting to nearly seven million pounds sterling. This Loan was redeemed on May 15 of this year.

By 1914, after many difficulties in the construction of the new wet dock had been successfully overcome, the port found itself in a position to meet the strain imposed on it during the War years. In taking over the undertaking of the Tanjong Pagar Dock Company, Limited, the new board had been saddled with a ship-repairing business which it proceeded to reorganize on businesslike lines. On the outbreak of hostilities the Dockyard Department was called upon to deal with a large amount of commercial and naval ship-repair work, and at the end of the War reaped its reward from the work of reconditioning vessels which had been laid up in Dutch East Indian waters.

Even with 11,000 feet of berthing accommodation, and five large graving docks, the need for extended facilities became apparent in 1923, and in 1927 I submitted a report on proposals to extend the facilities of the Wharf Department. This report was the subject of public discussion and debate during the years 1928 to 1930. My recommendations of Schemes C and D in this report were eventually submitted to and received the approval of the Imperial Shipping Committee, and in 1934 Messrs. Topham, Jones and Railton, Limited, secured the contract for constructing some 3,000 feet of new concrete blockwork wharves and eleven new transit sheds. The new facilities will be completed by the end of 1938, by which time a mechanical coal handling plant, for which Messrs. Fraser and Chalmers Engineering Works, Erith, have secured the contract, will also be in operation.

The Secretary of State for the Colonies, in a dispatch to the Governor, Sir John Anderson, in November, 1904, before the expropriation took place, stated :—

> "The management would be conducted by a Board on strictly commercial principles. The Board would be appointed by the Governor for fixed periods and its actions would be subject to his control, but his interference in the ordinary administration of the port management would be neither necessary nor desirable."

And the decision to run the management of the Board on commercial lines has, I submit, been fully justified. A progressive policy has been adopted from the outset, with the result that the facilities of the port have marched step by step with the steady increase in the trade of Malaya.

There are to my mind four additional factors which have contributed to the success of the Government's policy in regard to the management of the port, namely, a prudent financial control of all capital expenditure, the liberal policy adopted by the Board in encouraging transhipment trade, the maintenance of wharf charges at a steady, and by comparison with other ports, at an abnormally low level, and lastly, the natural advantages of the site on which the Harbor Board's premises are located.

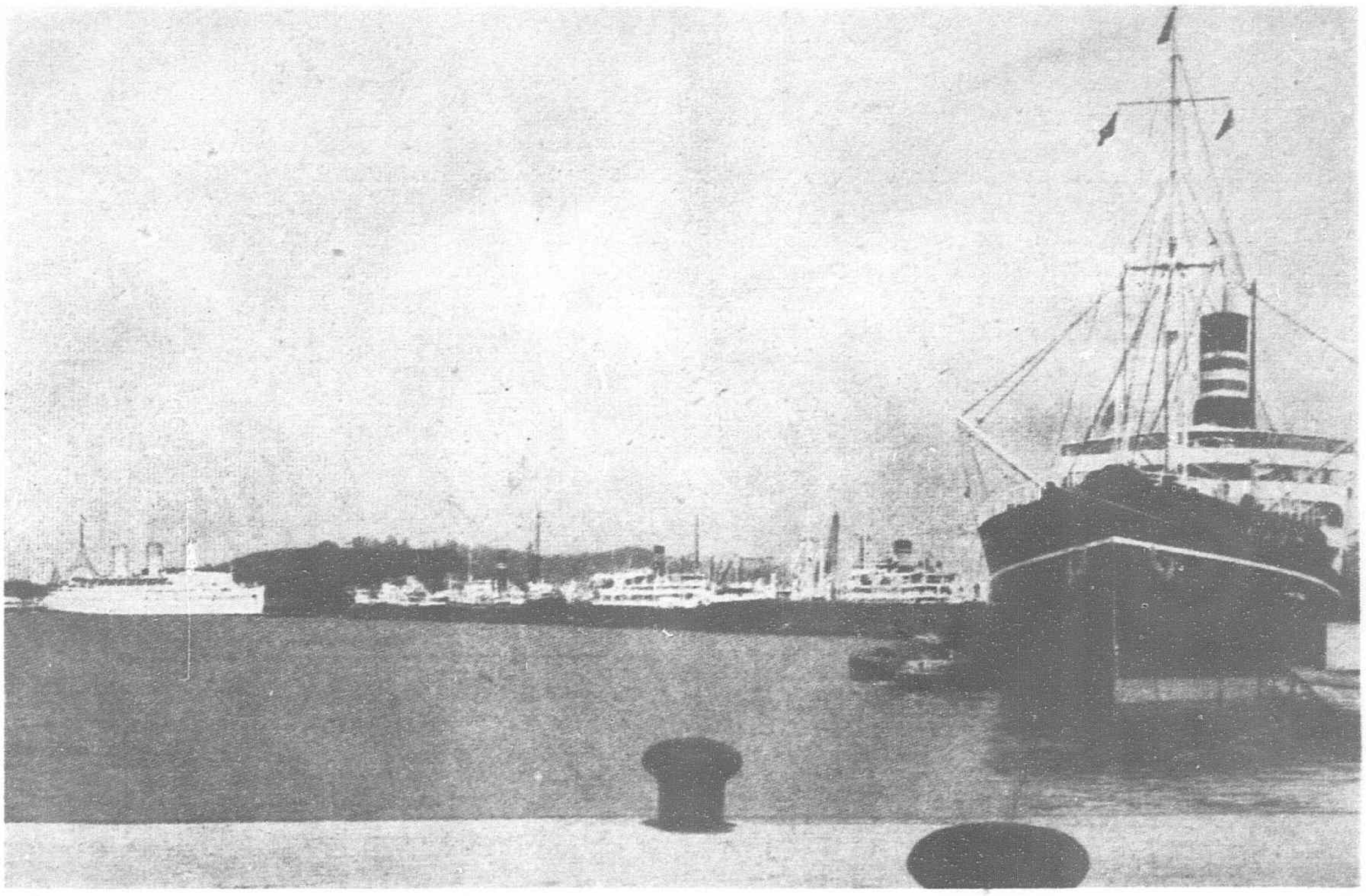
In the thirty odd years of its history it is impossible to cite any scheme in connection with the Board's development which has, with the approval of the Government, been carried into effect and which has not proved to be an economic and financial success. Despite the changing courses of trade the Board still handles a constant proportion of its total traffic as transhipment trade, and while the port adheres steadfastly to its free-port principles I am confident that shipping lines will continue to avail themselves of Singapore's unique geographical position for the transhipment of merchandise. It is of interest to note that the Board not only maintained its charges at a steady level throughout the War when other ports were increasing their rates, but the charges to-day compare favorably with those in operation before the War.

That this success has not been achieved without a considerable amount of anxiety and prudent management in the past goes

A part of the docks at Singapore

without saying, but I cannot stress too often the prescience shown by the early pioneers of the Tanjong Pagar Dock Company, Limited, who converted a mangrove swamp into a port and, in so doing, founded on an ideal site the modern port that Singapore is to-day. Few ports can boast of such a length of deep water berths which are swept clean by every tide, the use of a dredger, except during new construction, being unknown in Singapore.

When the extensions now in progress are completed in 1938, there will be nearly three miles of fully equipped deep water berths, approximately one and a-half million square feet of warehousing and transit shed accommodation, connected by rail to the Federated Malay States railway system, in addition to five large drydocks and up-to-date repair facilities capable of carrying out repairs to the largest vessels afloat.


Shipping at anchor in Singapore harbor

The Penang Harbor Board

In 1898, some three years before the anxieties of the Tanjong Pagar Dock Company, Limited, in Singapore, became acute, the Government of the Straits Settlements undertook in Penang the construction of Swettenham Pier and transit sheds. The facilities thus created, which for years had been the subject of agitation by merchants in Penang, were managed and operated by a department known as the Government Wharves Department.

Rates were levied for handling and shipping merchandise over the Pier, but the transit sheds were leased out to merchants who performed the usual junctions of landing, shipping and forwarding agents.

In 1907, in his summing up on a famous Bill of Lading case, Mr. Justice Thornton said :—

> " I would only add that the present system of discharging cargoes by means of native landing agents and other private firms, without large capital to look to in the case of loss, does not give satisfaction to the merchants and other consignees, and in the interests of the Port a better system might well be introduced.
>
> " The combined enterprise of the merchants of Penang, with the co-operation of shipowners whose lines call at the port ought, if I may venture to speak on such a point, I think be capable of bringing about such a result—but if that is impracticable possibly the Government itself may find it expedient to undertake the duty."

The Government of the Straits Settlements decided that some action on the lines suggested by Mr. Justice Thornton was essential, and in 1908 the Penang Committee of the Tanjong Pagar Dock Board, to which Board I have already referred, was entrusted with the management of the Government wharves.

Thus was formed the beginning of a connection between the ports of Singapore and Penang, as far as the management of their traffic and shipping facilities are concerned. The Committee recommended the extension of Swettenham Pier and this was completed in 1911.

In 1913 the Penang Committee of the Tanjong Pagar Dock Board ceased to function, the management and administration of the Port being handed over to a newly formed Penang Harbor Board, formed under the Ports Ordinance of the Straits Settlements.

This Board, constituted on the same basis as the Singapore Harbor Board, lost no time in developing the amenities of the Port. Penang differs essentially from Singapore in that the deep water channels, suitable for the development of a port, lie between the island and the mainland, and, after considerable discussion and negotiation, the Board purchased land on the mainland for the purpose of operating a ferry service for the use of the general public.

With the harbor situated between the Island of Penang and the mainland it follows that the traffic to and from vessels working at anchor proceeds in two directions, and as a result Penang has, in the past, been regarded as a lighter port. The Penang Harbor Board manages and operates a large fleet of lighters and works in keen competition with the lighterage fleets owned by Asiatic and other firms.

Penang, like Singapore, is a free port, and possessing the same natural advantages as Singapore, is able to operate its port facilities at low charges to shipowners, shippers and consignees. Situated at the northern end of the Straits of Malacca it lies in an ideal position for serving the trade and commerce of the northern end of Malaya, lower Siam and Singapore.

During recent years there has been considerable discussion as to the best means of developing the usefulness of the port, some favoring an extension of the existing wharfage facilities owned by the Board on the island, while others urge the construction of port facilities on the mainland.

In 1928 I presented a report on the two proposals ; but although the local viewpoint is at present opposed to development on the mainland, the time may come when the proposals for port facilities on the mainland will receive consideration. The wharfage accommodation at Penang cannot be said to be sufficient for the needs of the port, and experience in Singapore having shown that when additional accommodations is provided it is readily used by shipowners, I feel that, with the growth in the size of vessels using the port, the time is fast approaching when an extension of the existing facilities will become a pressing need.

The Future

Thirty years of Government control of policy of the port undertakings in the Straits Settlements, managed on commercial lines by boards consisting of commercial and business men, has, I feel, amply justified the step taken by the Colonial Office in 1905 in expropriating the undertaking operated in Singapore by private enterprise. The finances of both boards are sound enough to meet all calls that foreseeable developments are likely to make, while the rates levied for services rendered to shipowners, consignees and shippers are lower than in any other port in the world where equal facilities are provided.

At Singapore the West Wharf Extension Scheme, to which I have already referred, is being fully utilized as each section of new wharfage accommodation is brought into use, but the completion of this scheme will not halt the continuous development of the port. The next decade must be spent in reconstructing the only remaining

(Continued on page 360)

The Urals-Kuznetsk Combine

By A. M. ZERENINOV in the Economic Survey of the U.S.S.R. Chamber of Commerce

WHAT is the Urals-Kuznetsk Combine? It is a Socialist interrelated group of enterprises based on a combination of the Ural iron ores and coal resources of the Kuznetsk basin. The combine enables the immense supplies of raw materials in several districts to be utilized in the most highly nationalized and productive fashion by intensive development of transport and power supplies for the needs of mine and works production. The chief territory included by the Urals-Kuznetsk Combine is the Urals (Cheliabinsk and Sverdlov Regions), Orsk-Khalilov District, Middle Volga Region, Western Siberian Territory (chiefly the Kuznetsk District), Kazakhstan with its three rich mineral bearing districts—Karaganda, Ridder and Counrad.

The raw material bases of the Urals-Kuznetsk Combine are as follows:

Iron Ore.—There are the following six iron ore districts which are at present of industrial importance in the Urals: Nadezhdinsk, Tagilo-Kushvin, Alapaev, Bakal, Magnitogorsk and Komarovo-Zigazinsk.

Of the present reserves 475 million tons represent the reserves of Magnitnaya Mountain. Apart from the deposits referred to, there are also large reserves of titano-magnetite ore (more than a hundred million tons) in the Urals. These ores are of particular importance owing to the fact that they contain the valuable rare elements—vanadium and titanium which are used in the production of quality alloy steels.

The Khalilov deposits of complex ores are a continuation of the ore deposits of the Southern Urals. These deposits occupy an area of 2,000 sq. km. but only 100 sq. km. have been prospected. The reserves of the Khalilov ores amount to almost 400 million tons. The Khalilov ores contain besides iron such valuable metals as nickel and chromium. As a result of widespread geological survey work carried out in Siberia a number of first class deposits of iron ore have been prospected in the Gorno-Shorisk, Minusinsk, Abakansk and other districts, so that now the reserves of iron ore in West Siberia alone amount to 414 million tons. When the Kuznetsk foundry was first started it was considered that this works would operate almost entirely on Magnitogorsk ores brought from 2,300 km. away. In 1936, however, more than one quarter of the needs of the foundry were supplied by local ores.

These huge reserves of iron ore in the Urals and Siberia make it possible to develop the manufacture of iron and steel in the system of the Urals-Kuznetsk Combine on a very large scale. The metallurgical industry in the East of the Union has been developed to a certain extent by reconstructing and enlarging the old Urals works but to a still greater extent by building large new works.

Of the old Urals foundries which have been reconstructed during recent years mention should be made of (1) The Kabakov (formerly Nadezhdinsk) works, which has been converted into a large quality and extra-quality metal works. (2) The Zlatoust works—also a quality metal works which, after its reconstruction, has become, together with the Kabakov works, one of the chief suppliers of metal for the motor-tractor, and tool industries. (3) The Chusovaya works, which has perfected the production in its blast furnaces of vanadium pig iron from titano-magnetite ores, and now produces this metal on an industrial scale and converts it by a number of processes (open hearth slag, chemical and electric furnace treatment) into ferro-vanadium. In 1936 the Chusovaya works produced 300 tons of ferro-vanadium, so that there is every reason to suppose that in 1937 the U.S.S.R. will be made independent of imports of this valuable alloy. In 1937 the first few tons of another alloy, ferro-titanium, were produced at the Chusovaya works, this being one of the best de-oxidisers and an indispensable ingredient in the manufacture of important grades of alloy steels. (4) The Verkh-Isetsk works which has now become one of the chief producers of dynamo and transformer iron for use in electrical engineering. Besides these there are also the Nizhni Salda, Beloretsk and other foundries.

An idea can be formed of the scale on which reconstruction work has been carried out from the fact that at the Zlatoust works, for instance, several times as much money was spent on the reconstruction than the whole works had originally cost. The new plant installed included a blooming mill, a large preparatory rolling mill, a number of new open hearth furnaces, five large electric furnaces, including two fifteen-ton furnaces, etc. As a result of this reconstruction the output of quality rolled metal at the Zlatoust works has increased several times over during the past few years. At the Chusovaya works besides special shops and installations for the production of ferro-vanadium a large press (No. 800) has been built and installed and a large specialized rolling mill for producing steel springs of different shapes for the motor and rolling stock industries.

But all this reconstruction work, in spite of its large scale, is dwarfed by the gigantic building operations on the new metallurgical works of the Urals-Kuznetsk combine. One of the largest of these works is the Magnitogorsk metallurgical combine. The plan for the Magnitogorsk combine, after revision in connection with the Stakhanov movement, has been confirmed as follows:

(1) Mine giving production of twelve million tons of iron ore a year.

(2) Two ore-washing plants and one concentrating mill.

(3) An agglomeration factory with ten conveyer belts, capable of agglomerating five million tons a year.

(4) Crushing and magnetic concentration plants with an output of three million tons of crushed, concentrated and sorted ores a year.

(5) A huge coke and chemical works comprising ten batteries, each with 65 to 69 furnaces, producing 4,200,000 tons of coke a year and large quantities of valuable chemicals.

(6) Eight large completely mechanized blast furnaces with a cubic space of 1,180 cu.m. each and an output of 4,300,000 tons of pig iron a year.

(7) Twenty-nine 100 ton open hearth furnaces with a capacity of 4,800,000 tons of steel a year.

(8) Three blooming mills, three continuous preparatory and six finishing rolling mills to produce 1,200,000 tons of rails and 2,500,000 tons of various rolled goods a year.

An electric power station, large firebrick works, mechanical and casting shops, shops for manufacturing railway fish plates, etc., also form part of the Magnitogorsk Combine.

The electric power station is to have a capacity of 223,000 kw., that is to say, it is to be nearly four times as powerful as the Volkhov station and equal in power to the first section of the Dnieper station.

By the beginning of 1937 there had been built and were working at the Magnitogorsk Combine: four blast furnaces (the first was opened in 1933), twelve open hearth furnaces (the first was opened in July 1933), one blooming mill (put into operation in August 1933), two preparatory and five finishing rolling mills, four coke batteries, an electric station, a mine, etc.

In 1936 the Magnitogorsk works produced:

1,557,000 tons of pig iron,
1,164,000 tons of steel,
947,000 tons of rolling mill products.

Next after the Magnitogorsk works comes the Kuznetsk metallurgical works in Siberia, which is now complete. This was the first works to be built in Siberia although it is smaller than the Magnitogorsk Works, which is the largest in the country.

The Kuznetsk combine comprises:

(1) Mines, lime quarries, a crushing plant and an agglomerating plant with three conveyers.

(2) Five coke batteries with 55 ovens each with a yearly output of 1,800,000 tons of dry foundry coke.

(3) A large chemical works.

(4) Two blast furnaces with a cubic space of 821 cu. m. each and two with a cubic space of 1,163 cu. m.; capacity 1,740,000 tons of pig iron a year.

(5) Twelve 150 ton and one 300 ton open hearth furnaces with a total capacity of 2,150,000 tons of steel a year.

(6) A rolling mill shop with two blooming mills, a rail rolling mill, a medium sheet rolling mill and a mill No. 500 with a total capacity of 1,700,000 tons of rolled goods a year.

(7) A central electric heating station with a capacity of 140,000 kw. and a number of auxiliary shops.

In 1936 the Kuznetsk works produced:
1,363,000 tons of pig iron,
1,255,000 tons of steel,
859,000 tons of rolling mill products.

Besides these two giant foundries in 1937 the first units of the Novo-Tagil Metallurgical Combine (Urals) is to be put into operation in 1937 to work on Tagil iron ores. The first blast furnace, two open hearth furnaces and a mill for rolling railway tyres are to be put into operation at this works in 1937.

When complete the Novo-Tagil works will comprise four large blast furnaces, two open hearth furnaces, a blooming mill and a number of large capacity rolling mills. The Novo-Tagil works will give a larger production than the Kuznetsk works.

Of the works of the Urals-Kuznetsk Combine built since 1930 two more enterprises should be mentioned which, though they have a comparatively small output are nevertheless important because of the goods they produce. One of these works is the Cheliabinsk ferro-alloy works, which produces in its eleven electric furnaces many different kinds of valuable alloys including ferro-silicon, ferro-chrome, and ferro-tungsten. In 1936 the Cheliabinsk Works produced 35,000 tons of ferro-alloys, all of which were not formerly manufactured in the U.S.S.R. The other works is the Pervouralsk New Pipe Works, producing, with thoroughly up-to-date rolling mills, important kinds of iron pipes for locomotive building, motor and tractor manufacture and other purposes.

As a result of this construction work the production of iron, steel and rolled goods in the East has rapidly increased.

In 1936 the production of pig iron in the East increased by 340 per cent, of steel by 390 per cent and rolled goods by 400 per cent over 1930. The production of pig iron and rolled goods in the East in 1936 was only slightly less than the production of the whole of Russia in 1913, and the production of steel was greater.

The development of the iron and steel industry in the Urals has ensured an adequate supply of metal for the rapidly expanding engineering industry. Among the many engineering works in the East built between 1930 and 1936 the following should be mentioned:

(1) *The Cheliabinsk Tractor Works.*—The largest tractor works in the U.S.S.R. turning out high power caterpillar tractors. The first tractor was turned out by the Cheliabinsk works in May 1933 and in 1934 the total number produced was 10,102. In 1936 tractors were produced to the number of 29,000 and the production of Diesel engines was started.

(2) *The Uralmash Heavy Engineering Works.*—This works, opened in 1932 gave the foundries a large number of rolling mills, agglomeration conveyers, cranes and other important items of equipment. The total planned capacity of this works is 100,000 tons of equipment a year.

The works possesses some of the most perfected machine tools, many of them unique of their kind.

(3) *Ural Rolling Stock Works.*—This works when complete will turn out a larger number of railway cars than all of the old works put together. It turns out the latest types of hoppers, dumping cars, cistern cars, etc. There is also a large shop producing all-cast Griffin wheels for rolling stock. Metal will chiefly be supplied by the Novo-Tagil foundry which is in course of construction nearby.

(4) *The Cheliabinsk Abrasive Works.*—Producing lump carborundum and polishing wheels.

(5) *Sibselmash.*—Agricultural machinery works in Omsk.

(6) *Steel Bridge and Structures Works* in the Urals.

Non-ferrous metallurgy has a very important place in the system of the Urals.

The non-ferrous metallurgical industry in the U.S.S.R. has become chiefly concentrated in the East owing to the large reserves of all kinds of non-ferrous metals in the Urals and Siberia.

In the Urals, Siberia, Kazakhstan and the Altai there are large reserves of non-ferrous metals. With the exception of tin nearly all metals are found here in very large quantities. In the Urals-Kuznetsk Combine are found 90 per cent of the Union's reserves of copper, 70 per cent of the reserves of zinc and 75 per cent of the reserves of lead. Aluminium, nickel and magnesium ores are also found.

Kazakhstan is particularly rich in metals. Here there are the Jezkazgan, Ridder and Chimkent deposits.

There are now several large non-ferrous metal works in the system of the Urals-Kuznetsk Combine: the Krasnouralsk, Kalatinsk, Karabash copper smelters, the Pribalkhash copper combine, the Kyshtym and Pyshmin electrolytic works in the Urals, the Jezkazgan copper smelter, the Ridder and Chimkent lead works, the Belov zinc works, the Ufalei nickel works and others.

There are also mines in the Urals-Kuznetsk Combine providing valuable raw materials for the chemical industry. During the First and Second Five-Year Plans large chemical combines have been built in the Urals and Siberia of which mention should be made of the Berezniki Chemical Combine in the Sverdlovsk Region, a giant enterprise of the chemical industry, deposits of potassium salts in Solikamsk in the Urals, since the development of which the U.S.S.R. has become the largest producer of potassium fertilizers in the world, the Ural bichromate works, the Polevski cryolite works and the Perm superphosphate works.

All metallurgical production, as is well known, requires considerable supplies of electrical energy. A number of power stations have been built in the Urals and Siberia. Apart from the Magnitogorsk Station mention should be made of the Kemerovo station with a capacity of 48,000 kw., the Kuznetsk station—109,000 kw., the Kizel station—81,000 kw., Cheliabinsk—150,000 kw., and Berezniki—105,500 kw. In 1936 the district electric stations of the Urals-Kuznetsk Combine produced 4,250 million kwh. of electrical energy, which is almost 50 per cent more than in 1935.

The second most important industry of the Urals-Kuznetsk Combine is coal production. The Urals-Kuznetsk Combine was created with the object of developing the metallurgical and coal industries on a large scale in the East by combining the coal and iron ore resources in two enormous districts extending two thousand kilometers from end to end.

Of the total resources of the U.S.S.R. 84 per cent are in the Asiatic part and only 16 per cent in the European part of the Union. The Asiatic deposits, however, are very much less thoroughly prospected than those in the European part of the Union.

One is particularly struck by the fact that of the 400 milliard tons of coal reserves in the Kuznetsk basin only one milliard have been prospected. Geologists are still faced with tremendous work in the matter of disclosing the inexhaustible riches of the Eastern part of the Soviet Union.

The coals of the Kuznetsk basin provide the chief fuel for the enterprises of the Urals-Kuznetsk Combine, and also for the railways of the Urals and Siberia. These coals have a number of extremely valuable properties. The principal deposits have a calorific value of from 7,700 to 7,800, a low sulphur content (0.6 per cent) and a comparatively low ash content.

The third coal base of the U.S.S.R. (after the Donbas and Kuzbas) is represented by the Karaganda coal fields. Karaganda coals, like those of the Kuznetsk basin have good coking properties and are therefore very suitable for foundry work.

In the system of the Urals-Kuznetsk Combine mention must also be made of the Kizel coal district which is on the western slopes of the Urals and has reserves of almost three milliard tons.

The following table gives an idea of the progress in mine production of coal in the Urals-Kuznetsk districts.

COAL PRODUCTION
('000 tons)

	1930	*1936*
All districts of Urals-Kuznetsk Combine ..	6,078	26,600
Kuzbas (included in above)	3,685	17,400
Share of above districts in Union production (per cent)	12.5	21.6

During the last six years the mine production of coal in the districts of the Urals-Kuznetsk Combine increased by 340 per cent and in the Kuzbas by 370 per cent. The share of these districts in the total coal production of the U.S.S.R. increased from 12.5 per cent in 1930 to 21.6 per cent in 1936.

In conclusion stress must be laid on the close interrelation of the different industries in the system of the Urals-Kuznetsk Combine. This interrelation, which is a feature of the combined exploitation of the resources of the Urals and Siberia, is evident in several directions, as is seen by the following coupling:

(1) The iron and steel with the coke industry.
(2) The coke with the chemical industry.
(3) Metal production with machine building.
(4) Non-ferrous metallurgy with the chemical industry.

This coupling of industries on a large scale linked up with power and transport schemes represents a brilliant solution, on a planned basis, of the problem of developing the industries of these huge districts of the U.S.S.R. to the fullest possible extent and on the strictest principles of rationalization.

The Urals-Kuznetsk Combine is yet one more example of the great advantages of the socialist system of planned economy.

British Machines in Chinese Textile Industries

By Professor ALDRED F. BAKER of Chiaotung University

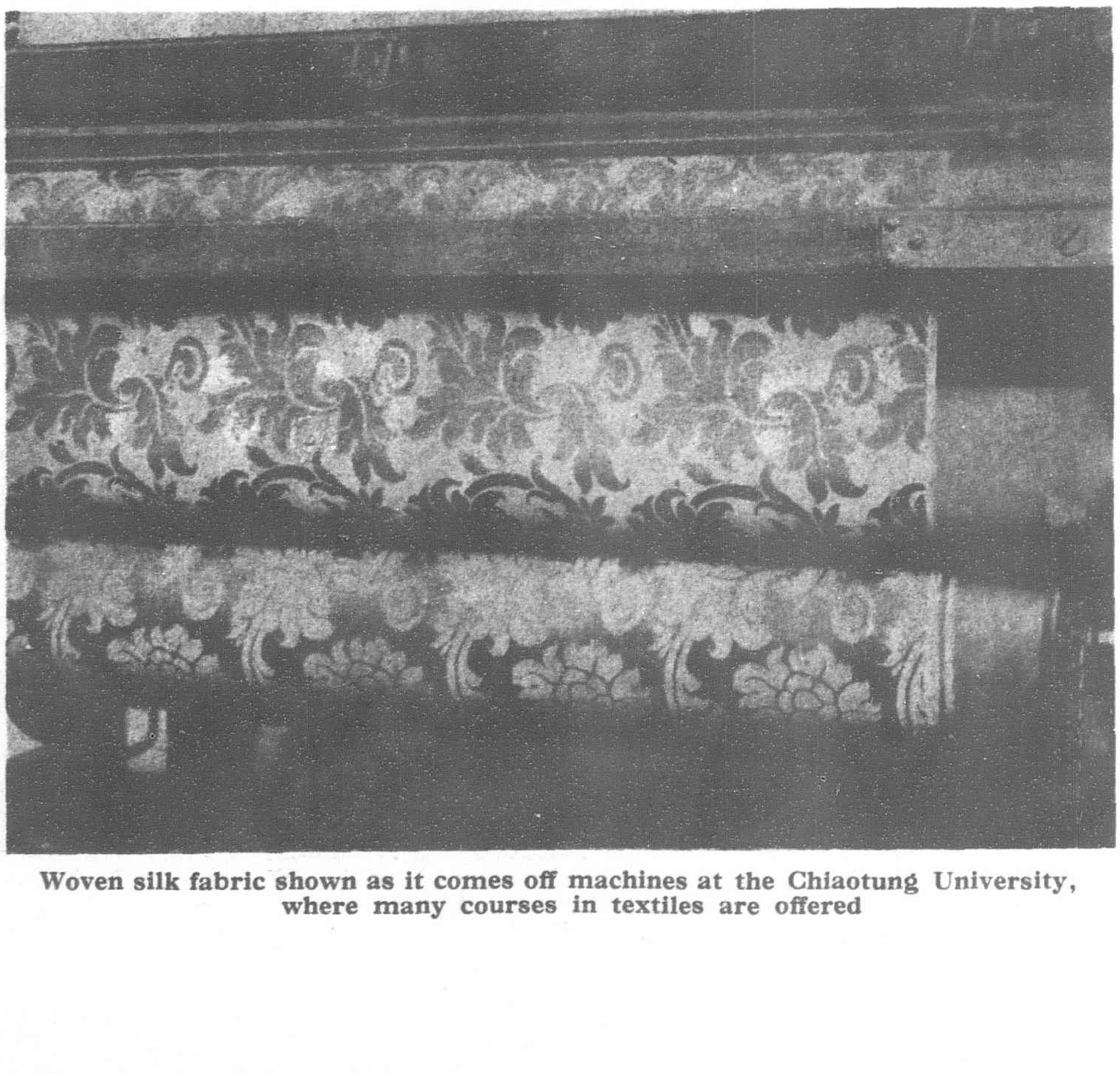
LOOKING back some fifty years into the history of the textile industries of China the dominance of silk cannot fail to be noted—a dominance which stretches back into the ages. It is interesting to note, however, that recent research is tending to show that even the Chinese silk trade was linked up with Europe and that the most elaborate weaving implementation, the draw loom, was an importation from Italy (vide Mr. K. C. Barker's lecture to the Shanghai Art Club on "Chinese Flowered Silks: Romance and Fact").

The present-day survival, however, of such hand-processes as cotton carding and hand spinning suggests that the "submerged tenth" would be clothed in materials much cheaper than silks. It is even probable that at one time Indian cottons were popular in China. Equally the survival in the rural districts of China of a wool industry, in which the wool used is cheaper than the local cotton, is evidence of the prevalence of wool clothing, particularly in the north.

Making all allowances, however, for these localized industries one may broadly state that to the silk industry of China the cotton industry has been added during the last twenty-five years; and further that the wool industry is now in process of being added. At this important epoch in the history of Great Britain it may be usefully stimulating to review the developments which have taken place in China with particular reference to the part which Great Britain has played in such developments.

British Aid Cotton Industry

Dealing first with the Cotton Industry: It may be noted that Great Britain has usefully aided China along three distinct lines. The first line was obviously the institution of cotton manufacturing under British control and stimulation. It would need considerable faith to start cotton manufacturing in the Far East on the part of those who knew of the efficiency of the cotton industry of Lancashire. But the attempt was made and it is probable that sufficient credit has never been given to those who made the attempt in the first place; to follow is simple—to initiate was quite a different matter! That there are now only three British cotton mills in China is not remarkable when the difference in cost between staffing a mill on the Western as against the Eastern scale is considered. But what these mills have meant to China from the points of view of imported skill and local stimulus can probably never be overrated.



Woven silk fabric shown as it comes off machines at the Chiaotung University, where many courses in textiles are offered

The second and probably the most important line was the discovery of the possibilities of China by the Lancashire textile engineers. As distinct from the wool industry the modern cotton industry is essentially a machine-created industry and the cotton industry of China is essentially the creation of the British machinists. To-day, however, the following are the numbers of British, Japanese and Chinese controlled cotton mills—

British	3
Japanese	41
Chinese	92

It would be well within the mark to state that at least 75 per cent of the machinery employed is British in origin. It is only quite recently that Japan has seriously threatened the simpler machine trade—to make a spinning frame in which European or American spindles are employed is not a very difficult matter, nor is there much originality displayed in reviewing all the American and European automatic looms and then constructing a composite loom! And here it may be well to note that even Great Britain had to draw upon American inventive genius: for both the ring and cap spinning frames are of American origin and the automatic loom while of Yorkshire origin was developed in the United States.

British Skill Imported

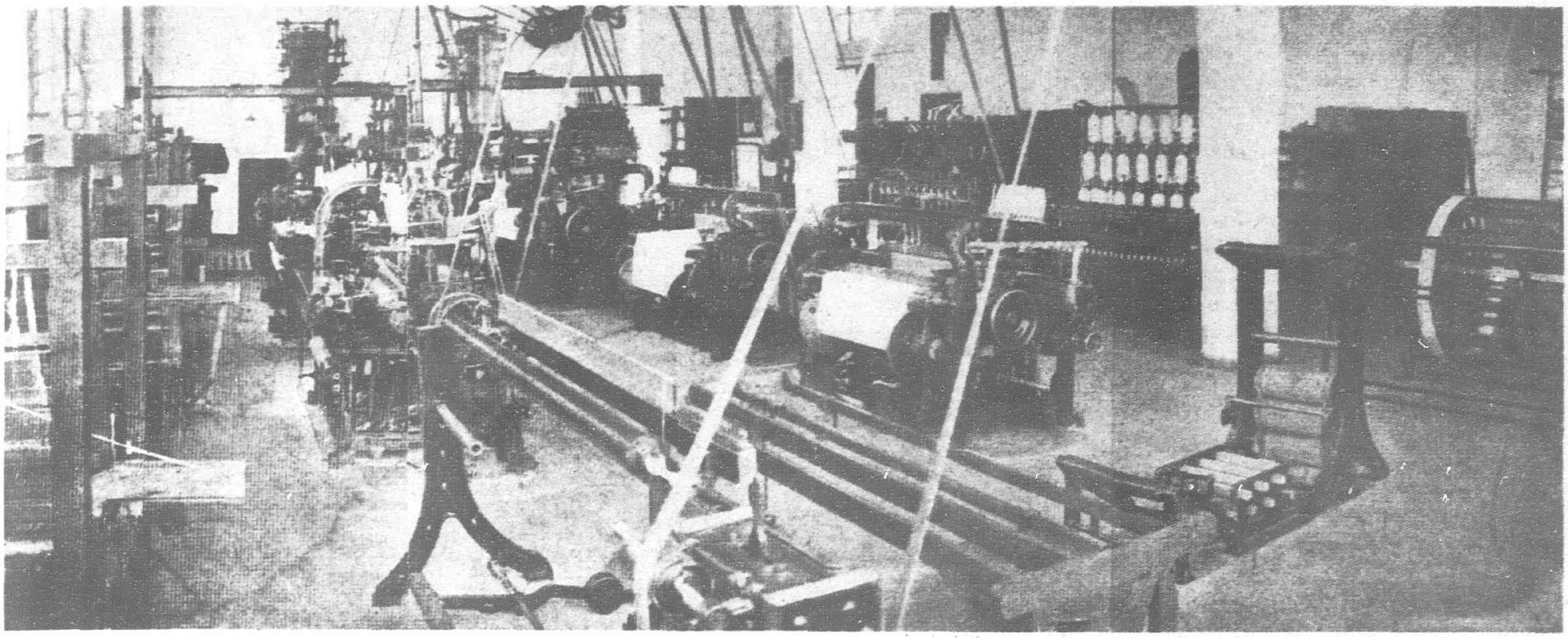
It will be obvious that the importation of British machinery into China would be accompanied by the importation of British skill which must have been a potent influence in every development which has taken place. Thus to-day China is manufacturing as much or even more cotton than Great Britain and ranks among the greatest cotton growing and manufacturing countries of the World. This may reasonably be attributed first, to British initiative; second, to British machine-making skill; third, to British manipulative skill; fourth, to Japanese capital; and fifth, to Chinese manipulative skill.

The third line of influence exercised by Great Britain has been the training of Chinese students in the British technological institutions, particularly the Manchester School of Technology and the Lancashire Textile Schools. Only quite recently one of the greatest Lancashire engineering firms protested against the exclusion of Chinese students from the local textile school well knowing the value of such students to their interests in China. Now although Chinese students have been given every opportunity to enter British textile schools with an eye to business it is perhaps well to remark here that such students are also accepted in their own rights and along much broader lines. Many of the British technological institutions look back with pleasure and satisfaction to their cultural associations with their Chinese visitors.

Popularity of Wool Grows

Turning now to the wool industry which is yet only in its initiatory stages: here also three periods of initiation are to be noted. Largely due to the importation of British wool fabrics the Chinese are being developed as a wool-wearing people, even silk in many cases being now supplanted by wool.

The second influence has been the development of the knitting yarn trade and the consequent development of hand-knitting in China. This development took on a larger outlook through the



Some of the many British textile machines in operation at Chiaotung University. Among these are cotton spinning, warping, [illegible] hand looms, cotton, silk and wool looms

establishment of a factory in Shanghai by one of the largest spinners of knitting yarns in Great Britain. In this case also the introduction of British skilled workers has followed, but local developments are even more quickly to be noted and it is now evident that China possesses a valuable asset in her operatives when these are rightly trained and are imbued with right ideals.

The third development, that of wool fabric production, is but in its initiatory stages but bids fair to take on a remarkable development. In this case, owing to financial considerations, the British wool machinists have not dominated to the same extent that the British cotton machinists dominated in the cotton industry. In view of the nature of Chinese wools it is open to question whether the adoption of the French " soft " spinning is wise, especially when the history of the Japanese " nun's veiling " trade is taken into account and the change which has come over the spinning industry even in Australia.

And this brings up the possibilities of the association of the British Dominions with China. It now appears that the association of Australia in the evolution of the wool industry has been altogether too timid but it is possibly not too late to change this attitude and to develop a useful association in future enterprise.

Work at Chiaotung

And here perhaps a word is called for with reference to the attempt which is being made at Chiaotung University to evolve a school worthy of the textile industries of China, especially with the probable development of the wool manufacturing industry in mind. Great Britain without demur allowed one of its most noted wool technologists to proceed to China to render first aid, and there is already established in the University small spinning, weaving and testing plants. This development, however, is only in its initiatory stages and it is now hoped that funds may be forthcoming to place this institution on a basis at least comparable with similar institutions in Japan. It is the continual complaint of those who really know that the interest in technology among the Japanese is remarkable as compared with that among corresponding Chinese and the cause is just this : that in China there has so far been no textile school based on broad cultural interests : and where else than in the noted engineering school of Chiaotung could such a center of cultural interest be so well developed ? Here is a case in which Great Britain quite unselfishly will aid China if China will aid herself.

Finally a few words upon the many indirect ways in which British developments and skill have helped or would help China. China is becoming a great country for cotton growing. At present the Chinese cotton manufacturer draws upon Egypt and India for supplies of raw material but the skill which has developed these countries should equally be utilized in the development of Chinese cotton growing. This probably does happen as the records of the development of cotton growing in Egypt and the records of the Indian research institutions are undoubtedly consulted by the Chinese research institutions which are now working upon this problem. With reference to wool the problems involved are but at their initiatory stages. British experts are already advising China on these matters and it is hoped to save China from the experimental difficulties which have attended the work of the Japanese at Sapporo and at Kungchuling. And in this case valuable assistance is already being rendered by the Oberlin Memorial School in Shansi under American supervision and by a noted English member on the economic staff of Yenching University.

Finally, reference may be made to the possibilities of the development of rayon (artificial silk) in China. The writer well remembers many years ago returning to Yorkshire from London with a small sample of the latest laboratory production of artificial silk and of the comment of one of his colleagues—" Cross has had many disappointments : let us hope that he will score a success at last ! " The sample was the first of " vescose " upon which the rayon industry of the world has been based ! Thus in the success which will undoubtedly follow the introduction of the rayon industry into China let us remember that it has been the persistent endeavors of a British chemist which have made this possible. Neither should China forget that the mercerising of the cotton yarn and cloth which is so important in the local industry is based upon the research work of the English chemist, Mr. John Mercer.

NEW GERMAN SCHOOL IN KOBE

In view of the increasing number of students, Kobe German residents are proceeding with plans for the construction of a new German primary school building in Kobe. According to the Japanese press the construction committee has already purchased a 400 *tsubo* plot of ground and laid down the cornerstone in the early part of June. The school, which at present utilizes a part of the Club Concordia, Kobe, began with an enrollment of ten students but as this has grown to 80 consisting of German, Swiss and Netherlands children, the local residents of these nationalities decided on the establishment of a larger school.

Manganese Production and Export

By A. M. GENSHAFT, in the U.S.S.R. Economy Survey

Manganese is one of the most important industrial metals, its principal use being in the manufacture of steel. Of the total quantity of manganese ore produced 97 per cent is used in the iron and steel industry and the remainder in the chemical and electrical industry. Of the former quantity 80 per cent is used in the manufacture of steel and ferro-manganese and the remainder in the manufacture of various kinds of pig iron.

Although manganese deposits are very widely distributed throughout the world the majority of countries with a developed steel industry either have no rich manganese ores (i.e. ores with a metal content of 30 per cent and more) or they have insufficient quantities for their needs and are obliged to import such ores from their colonies and other countries.

The U.S.S.R. which has a very highly developed steel industry possesses the largest supplies of rich manganese ores in the world. The reserves of high grade manganese ore in the U.S.S.R. represent 50 per cent of world reserves. The U.S.S.R. is in a position, after supplying its own iron and steel industry with all the manganese ore it requires, to supply a considerable proportion of the high grade manganese ore required by the iron and steel industry in other countries.

The chief deposits of manganese ore in the U.S.S.R. are at Chiatura in the Soviet Republic of Georgia (Caucasus) and at Nikopol in the Ukrainian S.S.R. The following figures give the mine production of these two deposits between 1913 and 1936.

MINE PRODUCTION OF MANGANESE ORE

(Chiatura and Nikopol)

Years	*Total '000 tons*	*Percentage of World Production*
1913	1,261	53
1934	1,734	59
1935	2,350	62
1936 (plan)	2,800	—

From the above figures we see that the mine production of manganese ore at Chiatura and Nikopol has very greatly increased during recent years. In 1930 production exceeded pre-war production and in 1936 it was twice as great as in 1913.

There was a particularly marked rise in production in 1935 and 1936. The Stakhanov movement which began at the end of 1935, very greatly influenced methods and forms of work and consequently also the output of the manganese industry of the U.S.S.R. The output of manganese ore in 1935 was 36 per cent greater than in 1934 and 13 per cent greater in 1936 than in 1935.

The Chiatura Manganese Trust fulfilled its 1936 plan by November of that year and completed its program under the Second Five-Year Plan in four years.

As the mine production of manganese ore has increased, consumption of the ore within the U.S.S.R. has also increased owing to the great development of steel production. The production of steel in the U.S.S.R. in 1936 was nearly four times as great as in 1913 amounting to about 16 million tons against 4,400,000 tons in 1913. The manufacture of quality steels and ferro-manganese has made particular progress and this naturally creates a great demand for manganese ore.

However in spite of the greatly increased consumption of manganese ore within the country a considerable surplus of ore has remained and this has been exported.

In 1913, 98 per cent of the total ore mined was sent abroad, while within the country very little was used. In 1934 the U.S.S.R. exported only 42 per cent of the quantity mined and in 1936, 24 per cent. The U.S.S.R. exports only that quantity of manganese ore which remains over after domestic needs have been met.

Manganese ore has been exported for many years to all the principal industrial countries in the world where it is consumed by all the large iron and steel trusts. During recent years Soviet manganese ore has made up the following percentages of total supplies of the ore imported to the countries given during recent years.

SHARE OF SOVIET MANGANESE ORE IN TOTAL ORE IMPORTED BY VARIOUS COUNTRIES

(in percentage)

	U.S.A.	*France*	*Belgium-Luxemburg*	*Italy*	*Poland*
1933	34	38	48	82	95
1934	37	23	50	53	95
1935	40	25	10	50	69

Such large concerns as the Bethlehem Steel Corporation, the United States Steel Corporation, the Société du Manganese en France controlling about 75 per cent of the manganese metal industry, and the iron and steel concerns of Belgium and Luxemburg, have for some time supplied a large part of their needs with manganese ore imported from the Soviet Union.

The manganese ore mined at Chiatura, which is the only ore which has been exported from the U.S.S.R. during recent years, is of a type which is particularly valuable in the iron and steel industry and especially in the production of ferro-manganese. Two grades of ore are exported from Chiatura, the concentrated (washed) grade and the ordinary grade. The content of these ores is shown in the following table.

GRADES OF CHIATURA MANGANESE ORE

(content in percentage)

Grade	*Metallic Manganese*	*Silica*	*Phosphorus*	*Iron*	*Moisture*
Washed	50—53	9—7	0.18—0.20	1—1.5	8—9
Ordinary	45—48	15—12	0.18—0.20	1—1.5	10—12

Both grades are entirely free from harmful impurities and are in a finely granular state.

For the production of ferro-manganese manganese ore with a low iron content is particularly valued, and Chiatura ore is superior in this respect to ore from other deposits.

The main deposits of Chiatura are connected by rail with the Black Sea port of Poti which is 127 km. distant and is free from ice all the year round.

From the nearest European ports of Rotterdam and Antwerp the Chiatura deposits are separated by 3,800 miles and from Baltimore by 5,800 miles. Their very favorable situation gives the Chiatura deposits a great advantage over deposits in other countries.

To this must be added that the port of Poti has been equipped in recent years with all the latest mechanical appliances for loading vessels and a steamer with a carrying power of five to six thousand tons can be loaded in a day. In the port itself there is a wide area for storing and sorting ores.

The Soviet Government has always paid considerable attention to the manganese industry and assigns large sums for its reconstruction. During recent years mining operations have been considerably extended at Chiatura and large new areas are now being worked. The mining and haulage of manganese ore has been almost completely mechanized and new concentration mills with a considerable output have been opened.

As a result of these measures there has been a great increase in mine production, an improvement in the quality of ore and a lowering of costs of production.

The proportions of the two grades of ore exported during the last three years were :

EXPORTS OR WASHED AND ORDINARY ORE

(percentage)

	Washed	*Ordinary*
1934	70	30
1935	62	38
1936	86	14

(Continued on page 360)

Malaya's Great Tin Mining Industry

By Victor A. Lowinger C.B.E. in Special Malaya Supplement of "The Financial News"

During the last few years so many articles have appeared in the financial and mining journals analysing the position with regard to tin in the chief producing countries, that the circumstances of each country must be well known, and it is difficult to add anything to what has already been said. No review, however, regarding Malaya and its prosperity would be complete which excluded the tin industry on which the country's prosperity was initially built.

In dealing with this subject it is necessary to differentiate between the various divisions of the country, for although the tin industry has contributed materially to the prosperity of Malaya as a whole, it is the Federated States, where practically all the tin is produced, which have directly benefited, and which were primarily developed by tin mining. Even to-day, only three per cent is produced in the Unfederated States and an almost negligible quantity in the Straits Settlements.

Although tin has been mined in Malaya for hundreds of years, the modern history of tin mining may be said to have begun with the war between the two clans of Chinese who were mining in Perak in the early seventies. The story is well known how, owing to the fight between these two factions and also to the rival claims of various aspirants to the Sultanate, the chaos in Perak was so complete that Sir Andrew Clarke, Governor of the Straits Settlements, was obliged to interfere and to restore order. The British administration of the Federated Malay States dates from that time.

It was the Chinese who were the pioneers of the modern mining industry, and who for many years practically monopolized the production of tin. Mr. Warnford-Lock, a noted mining engineer in the early part of this century, wrote, in 1907, in the foreword to his book, "Mining in Malaya": "The Chinese coolie is the embodiment of the present mining industry of Malaya. He, and he alone, has made it. His counterfeit presentment on the Malay postage stamp would be much more appropriate than the tiger which now does duty as a badge. But, he is destined to pass away, and give place to machinery."

The complete records of tin production in those early years are not available, but in a book written in 1882 by Mons. M. J. Errington De La Croix, who was sent out on behalf of a French company, very soon after British influence had begun to restore order, we find the production of tin for 1876 from the districts of Larut and Lower Perak given as 2,054 tons, nearly all of which came from the vicinity of Taiping. The great tin-fields of the Kinta Valley do not appear to have been developed in any way at this time, production being almost entirely from the Taiping district, which, in 1880, produced nearly 4,500 tons of tin out of a total of 5,500.

European Assistance

With the security given by the British administration, development proceeded at a much faster rate. Reliable records from 1889 onwards are accessible. By that year, the production had increased nearly fivefold, and, in 1890, 27,000 tons of tin were exported. There were a few European mines, but, even so, nearly the whole production came from Chinese sources. After that, however, mines owned by Europeans began to contribute an appreciable proportion of the output, and, in 1900, when for eight years the output had averaged more than 40,000 tons, the proportion of European production to Chinese was approximately 15 to 85 per cent. During the decade between 1900 and 1910, the output continued to increase and averaged nearly 50,000 tons, the European share being 22 per cent. The figures remained comparatively steady until 1915, when there was an appreciable drop in the production owing to the war, which led to a lack of engineers and a shortage of mining machinery.

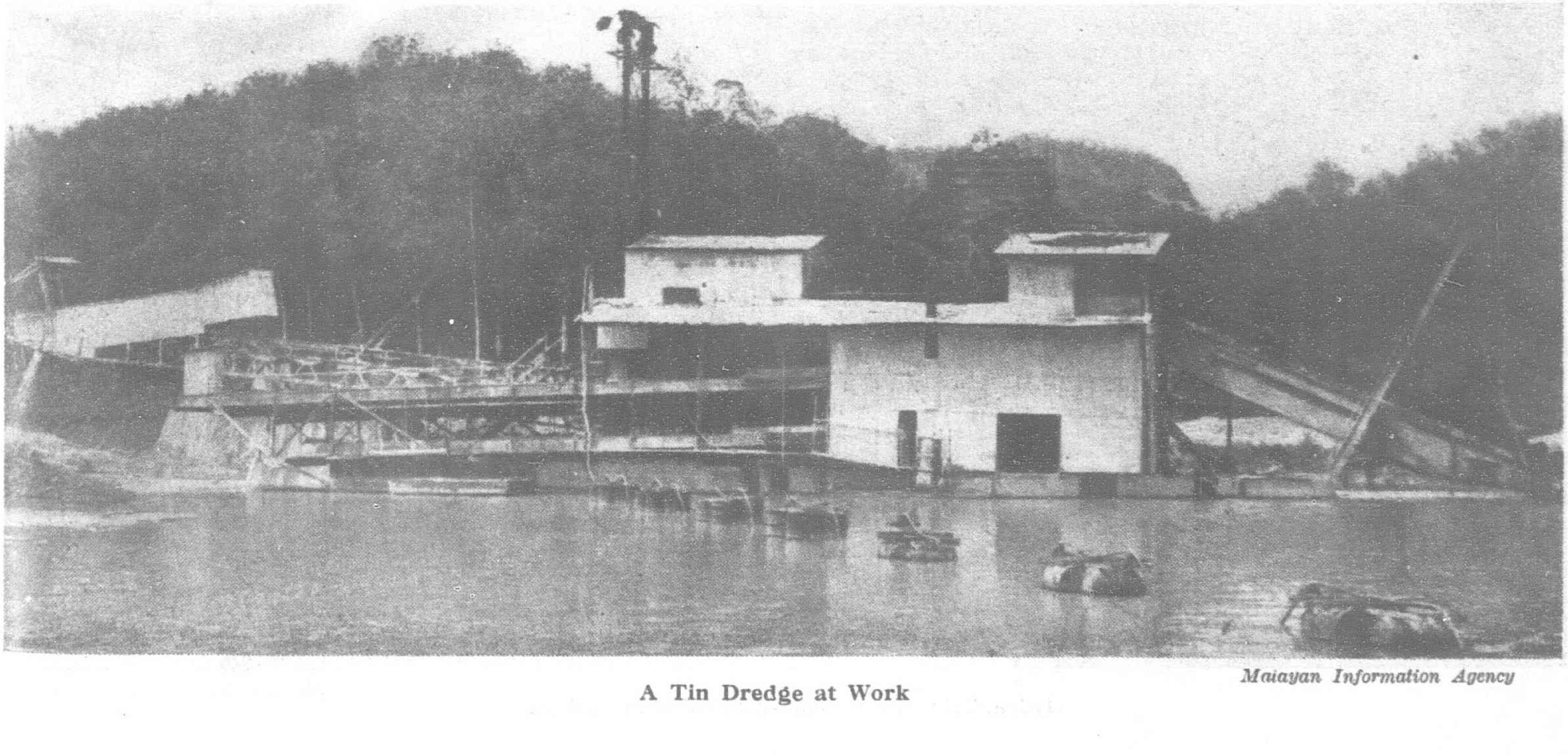
The year 1912 marks a distinct epoch, for in December of that year the Malayan Tin Dredging Co.'s Number 1 Dredge was completed, and a small bucket dredge was working at the Tronoh Mines.

In 1913 and 1914, the Malayan Tin Dredging Co.'s dredge produced an aggregate of about 350 tons of tin, the Tronoh Dredge being out of action. But progress was rapid from then onwards, and in 1915 there were ten dredges in operation which produced 1,500 tons of metallic tin.

The actual pioneer of dredging for tin, however, was Captain Miles, who, prior to 1911, had installed five dredges in Tongkah Harbor in Siamese territory. Progress continued, and by 1920 there were 20 dredges operating; 50 per cent was added to this number in the following year, and in 1926 there were 50 dredges, with many others under construction.

More Machinery

About this time, the design of dredges underwent a change, in the sense that they became larger and were able to dig deeper. The increase continued, 20 being added in 1927 and by 1931 the number had reached 120.



A Tin Dredge at Work

Malayan Information Agency

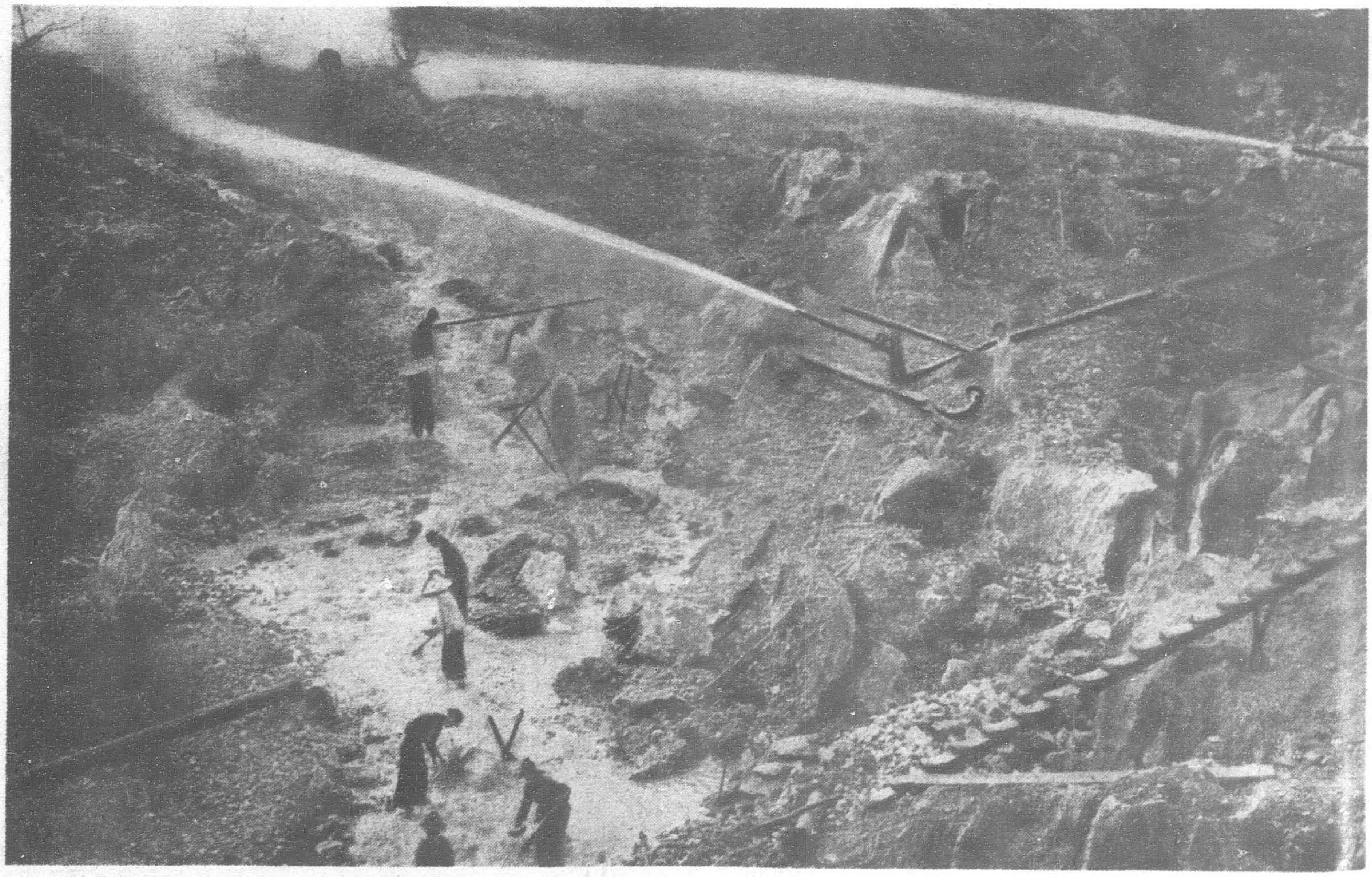
The output of tin had, of course, increased with the installation of new units of machinery, and owing to the increasing demand of the years subsequent to 1923, production expanded rapidly, reaching its peak in 1929 when nearly 70,000 tons of metallic tin were exported from the Federated Malay States. Between 1929 and 1931, several very large dredges were under construction, and while the control scheme was based on the production of the year 1929, by the time that it came into operation, in 1931, the capacity of production had increased to 95,000 tons, and to-day stands at approximately 100,000, of which 59 per cent is attributed to European mines, the majority of which are dredging concerns, and 41 per cent to mines operated by Chinese. Of this 41 per cent, 34 per cent is from mines owned and worked exclusively by Chinese, and seven per cent from European owned mines leased to Chinese.

Comparing the early part of the century with to-day, these figures show that the production by Chinese miners, though it forms a far smaller proportion of the total, is approximately the same tonnage as it was then, so that, although Mr. Warnford-Lock was in a sense correct in so far as most of the modern development can be attributed to mines owned by Europeans and worked by machinery, it is far from true that the Chinese miner has passed away. M. De La Croix estimated the number of Chinese actually working in the mines in 1880 at about 12,000. The confidence inspired by the security given by the British protection and administration is evidenced, not only by the rapid increase of development and output of tin, but by the fact that in 1907 nearly 90,000 Chinese were engaged in mining. This number has undergone various fluctuations dependent on the economic conditions, the peak being about the end of 1927, when of a total of 123,000 laborers engaged in mining, 108,000 were Chinese. During the slump the numbers naturally decreased tremendously, because, for a considerable period, Malaya was, by the restriction scheme, reduced to a production of 24 per cent of the assessed capacity, but since the recovery of trade and the consequent increase of quotas, there has again been a large increase in the numbers, and it is reasonable to assume that during this year the number of Chinese engaged in mining will again reach 100,000. The prediction that the Chinese miner is "destined to pass away" has not been fulfilled. So long as the tin-mining industry in Malaya continues, the Chinese will be an essential factor in tin production.

The principal producing units are the dredges and the gravel pump mines. Of the former, there are 68 properties now being worked, and of the latter, 527. The balance of the output is produced by mines worked by hydraulicing and by lode mines, the principal lode mine being that of the Pahang Consolidated Co. Situated near the East Coast, it is one of the biggest tin lode mines in the world. With the addition of similar workings where no machinery is used, there were at the end of 1936, 915 different properties from which tin was being produced.

The above statement describes briefly the development of tin mining during the last sixty years. It may be interesting to review briefly the contribution which mining has made to the development of the country.

It is no exaggeration to say that the development in the F.M.S. has been built up on the foundation of tin, for, leaving out the very earliest years, we find that in the twenty years 1889 to 1908, during which period the revenue increased fivefold, the export duty on tin provided 38 per cent of the total. At the end of that period, before the rubber industry, which has now grown to such great proportions, contributed anything directly to the revenue, there were more than 400 miles of railway and 1,800 miles of metalled roads, almost exclusively in the western area. The State of Pahang, which embraces half the area of the F.M.S. and is separated from the Western States by a high mountain range, was then almost entirely undeveloped. Even to-day, when many other sources of revenue are available, when the production of rubber, subject to export duty is greater than that of any other country in the world, when duties which did not exist in the earlier days are levied on imports, the export duty on tin is still the greatest single item of the F.M.S. Government revenues, and averages approximately 15 per cent of the total. It reached its peak in the year 1927, when it amounted to almost exactly £2,000,000, and it is not unlikely that it may equal that sum during the current year. The total revenue derived by the Government from the duty on tin during the last fifty years has been £45,000,000 out of a total of £230,000,000, or almost exactly 20 per cent.



Malayan Information Agency

Hydraulicing in an open-cast mine in Malaya

Future Prospects

The area of British Malaya is approximately 51,000 square miles, of which just over 9,000 square miles have been alienated. Part of this is still undeveloped, and it is estimated that 84 per cent of the total area is still in primeval jungle. It is natural that the main development should have occurred in the narrow belt on the West Coast, as it is on the highway to the East and is approached through the sheltered waters of the Straits of Malacca. With the exception of the Pahang Consolidated Lode, it may be said that there is no large mine on the eastern side of the main range, so that nearly the whole of the tin has been produced from an area in the narrow western belt, 150 miles long and about 50 miles wide.

The State of Perak produces more than one-half the total output, and of this, 80 per cent comes from the Kinta Valley, which was the site of the main development in the early years of the British administration. On several occasions, the opinion has been expressed that the tin deposits would soon become exhausted. Sir Frank Swettenham, in *British Malaya*, written in the year 1906, mentions this opinion, saying that he did not agree with it, but from time to time it has been advanced again. The Chinese have a theory that tin grows, and it is not difficult to understand why this idea should have become prevalent among them, because there are so many places in the Kinta Valley and elsewhere which have been worked more than once with profitable results. What has actually happened is, that the improvement of methods and machinery has made it possible to work ground which had been mined before, and ground of a very much poorer content than was formerly the case, and to delve deeper into the earth to reach underlying tin-bearing material.

Low Cost Dredging

It is interesting to read what Mr. Warnford-Lock wrote thirty years ago. He predicted that only European capital and modern machinery would be able to deal with many of the deposits in Malaya. He went on to say that: "If these unwrought riches are destined, as they unquestionably are destined, to play a great part in the future welfare of Malaya, and the future tin supplies of the world, what is to be expected of the incomparably more widespread alluvial deposits? Worked though these have been for generations past, scoured as the country has been for rich patches by a most patient and painstaking race overwhelming as the tin production of this country has been in excess of that of all the rest of the world put together for many years, the real development of the Peninsula's mineral wealth is only now beginning. Not only do vast territories remain absolutely unexplored and untested, but a huge area has been superficially prospected and condemned in ignorance. Yet a day will come when great stores of tin will be won by mechanical means from land which the Chinese coolie has worked and abandoned."

With regard to the alluvial deposits, he has already proved to have been correct, and the development in design of dredges with their large capacity and consequent low cost, combined with the depth at which they are able to operate, has made it possible to work at a profit deposits which a few years ago could not be dealt with on a paying basis, partly because of the low ore content and partly because of the cost of moving the overburden before reaching the tin-bearing strata. Moreover, the end of that process has not yet been reached.

Since 1931, there has been little prospecting to locate other deposits because the existing productive capacity is so large in comparison with the standard tonnage allotted to Malaya under the international agreement. There is no reason, however, to suppose that the western States have a monopoly of the tin-bearing ground of the Peninsula, though it is natural that development should have occurred, in the first place, on that side on account of its accessibility. On the eastern side of the main range, tin-mining was carried on at various points many years ago and abandoned only because of the heavy cost of transport.

As has been stated before, the biggest tin lode mine is close to the east coast, and at various points on that coast profitable mines have been opened up. In the south of Johore, also, development has occurred of recent years, and, quite recently, a large source of tin supply has been found in conjunction with iron ore. In fact, there is no part of the Peninsula in which it would be safe to assume that tin will not be found when necessity leads to careful prospecting. No one can predict what developments may occur, but in so large an area of comparatively unexplored ground, there may be other Kinta Valleys which will yield to future generations the same results as those now being achieved on the western side.

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The Outlook for Tin

Related to the foregoing, a supplementary article that looks into the future for tin, by Cap. Oliver Lyttelton, D.S.O., M.C., also is published in the Special Malaya Supplement of "The Financial News." This is as follows:

THE position and prospects of the tin industry are of interest to a number of tin producing countries. They are especially vital to Malaya. The importance of the metal to Malaya may be indicated by a few figures. Malayan mine output, in terms of fine tin, last year amounted to 66,806 tons; this was 38 per cent of the total world production. The next largest producer, the Dutch East Indies, mined 31,546 tons, or much less than half of the Malayan output.

The value of the mine output of tin in Malaya, last year, when the price averaged approximately £200 per ton, was £13,360,000. To-day with the international export quota at 110 per cent, Malaya is permitted to export tin at the rate of 79,134 tons per annum, which, at the current price of over £250 per ton, is worth £20,000,000. In 1932, the worst of the years of trade depression, the value of the Malayan tin output was under £4,000,000.

The labor force engaged in mining numbered 78,000 at the end of 1936, and the number of mines using machinery or employing fifty or more coolies was 915.

It is particularly interesting to note the progress in Malaya of tin dredging. This is the most "capitalistic" and generally the cheapest method of working alluvial deposits of tin, and it has made great headway. There are, to-day, seventy dredging companies registered in the F.M.S., with an issued capital of nearly £15,000,000 and a market valuation of several times this figure. In 1936, 47 per cent of the total tin output of the F.M.S. was won by dredging; ten years earlier the proportion was only 27 per cent.

It is not only in the mining of tin that Malaya takes first place; her smelter output is even bigger than her mine output. The large smelters at Penang and Singapore treat tin concentrates imported from several other countries (particularly from Burma and Siam), as well as from Malaya. In 1936, the Straits Settlements imported 19,421 tons (tin content of ore), from countries other than Malaya, and their smelter output was approximately 50 per cent of the world total.

Twenty per cent of the total revenue of the Government of the Federated Malay States was derived from export duty on tin during 1936. The revenue from this source over the last five years was as follows:—

1932	$3,594,000
1933	$4,886,000
1934	$8,886,000
1935	$9,700,000
1936	$13,409,000

These figures show how important a rôle is played by Malaya in the production of tin, and how vitally the fortunes of Malaya are affected by the course of tin consumption and prices.

What are the prospects of this industry? Can its future be predicted with any certainty?

The background of the picture is the International Restriction Scheme, recently renewed for five years. There is no need, to-day, to put the scheme into the foreground.

Consumption of tin is high, and appears to be still growing. Even if production was entirely uncontrolled, the price of tin might not drop far ; there would certainly be no slump.

Again, demand has undoubtedly exceeded the needs of consumption.

In these circumstances, more than once the International Tin Committee has found itself, like King Canute, commanding the waves of prices to recede. And more than once its feet have got respectably but definitely wet. The reason has already been given. Prices, in the short run, depend not upon consumption or its needs, but upon demand. No statistical and few empirical horoscopes can foretell when changes in the comparative values of currencies —unfounded fears of shortage—armament programs—or the like will drive the consumer to buy above his needs and to gather reserves in his warehouses.

But one day the trend will be reversed : the rate of consumption will slow down ; tin will be produced in excess of demand ; prices will fall. The policeman, who is to-day in uniform, will emerge from the police station where he is idling, will arrest production, and save the industry from selling its exhausting assets below the cost of production.

It was different when demand slumped after 1929. Falling prices did not quickly bring about reduction in output, and stocks rapidly increased. Attempts to curtail production by voluntary agreement were made in 1930, but they failed. Finally the Governments of Malaya, Nigeria, Bolivia and the Dutch East Indies agreed on a scheme of compulsory restriction. By March, 1931, when it started, stocks had risen to over 51,000 tons, and they continued to rise until they reached 60,000 tons in April, 1932. The task, therefore, was not merely to check a further increase in stocks : it was to reduce stocks to a normal level.

There should be no similar problem in the next year or two, or whenever it may become necessary to impose higher rates of restriction. The present scheme starts with no handicap of excessive stocks.

Moreover, it benefits from the experience gained between 1931 and 1936. The working of restriction is now more elastic.

Producers are allowed to accumulate stocks of tin ore up to 25 per cent of their standard tonnages. This lessens the danger of a temporary shortage caused by a sudden jump in demand at a time when it may be difficult to produce more tin concentrates quickly.

Experience has shown that it is desirable to preserve a free market price, which changes in response to changes in supply and demand in all parts of the world. The value of normal speculative activity in a free market must be retained.

I might stress here that speculative activity is the more beneficial the better it is informed ; and it is, therefore, relevant to draw attention to the comprehensive statistical bulletins which are issued each month by the International Tin Research and Development Council. Further, the Council has just published a Statistical Year Book, 1937, which contains a great amount of information on all aspects of the industry.

Now, the restriction scheme cannot ensure to-day's rate of profit or a higher rate of profit. That depends upon. Consumption It can prevent disaster ; it can conserve resources.

It would, however, be disingenuous not to touch upon the disadvantages inherent in the scheme—certainly the first complete, and perhaps even now the most comprehensive, of all schemes to restrict the production of a primary commodity, and in this article it will be appropriate to refer chiefly to the dangers to Malaya.

In the five years of comparative security to follow, other producers will have the opportunity of prospecting, of developing their resources, modernizing their plants, of accumulating reserves of money as well as of metal. If restriction is not renewed, their competition, partly built up on the sacrifices which the lowest cost producer, Malaya, has made, will be more acutely felt. But there is an answer, and the Malayan industry is alive to these dangers. The equipment of the industry is being enlarged, reconditioned and modernized. There are signs that the urgent need of allowing the prospector access to her undeveloped resources is recognized.

It would be an insult to suggest that Malayan producers are sinking into a decadent idleness while they sun themselves in the warmth of present-day conditions. It would be an insult to them not to predict that the day when restriction comes to an end, if it ever does, will find them ready to meet competition armed with the latest equipment, capable of greatly increasing their production at short notice, standing upon great reserves of proved but unworked ground.

There are no signs that the Government is less enlightened upon these subjects than upon others, but while keeping to every line of the restriction agreement, latitude must be given in the granting of prospecting rights, dormant assessments and even mining titles, above all to present producers.

Given this, it can be confidently predicted that Malaya, with her still vast reserves of ground, with her large cash reserves, her modern equipment, her technical skill and experience, her enterprising managers, will remain as predominant and as unassailable in this industry as ever.

The Ports of the Straits Settlements

(Continued from page 351)

section of wooden wharf, known as the East Wharf, and in constructing an additional dry dock of sufficient size to accommodate the oil tankers that are increasingly using Singapore as a base for their operations.

The growth of Singapore as a military and naval station may bring some slight additional revenues to the Harbor Board (although most of the tonnage for these purposes will probably be handled at the Naval base), but the ultimate prosperity of the port as a whole must depend, I submit, on the maintenance of the port services at present provided at the lowest possible rates with the greatest possible efficiency. Within the next twenty years or so, if the size and tonnage of vessels engaged in the Far Eastern trade continue to grow, further wharfage extensions will be required to give the necessary facilities and dispatch to vessels passing through the port. When this occurs the Scheme A of my report, prepared in 1927 for converting the East Lagoon into a wet dock for ocean-going vessels, will probably be adopted.

As to Penang, as I have already stated, an increase in wharfage accommodation is likely to be a matter for earnest consideration during the next few years if the port is to retain a hold on its present trade.

The management of the ports of Singapore and Penang by the boards comprised of commercial men, has, I consider, indicated an efficient and workable means for developing and advising on a policy for co-operating the road, rail and port facilities in Malaya. Although some may consider that such facilities are not yet ripe for co-ordination it is my view that the solution to the problem of uneconomical and unregulated competition between the different forms of transport in this part of the world may be found by a similarly constituted board advising the Government somewhat on the lines which have proved successful in the organiztion and development of the port facilities of the Straits Settlements.

Manganese Production and Export

(Continued from page 356)

Moreover, of the washed ore exported in 1935, 60 per cent contained 52 to 51 per cent of metal while during the first six months of 1936, 79 per cent of the quantity exported contained this percentage of metal.

The quality of ordinary ore has shown a still more marked improvement. In 1935 of the ordinary ore exported 76 per cent contained 45 per cent of metallic manganese while during the first six months of 1936 only 40 per cent of exports consisted of this grade and there was a great increase in the quantities of 48 per cent ore exported.

Stakhanov methods are helping to increase the productivity of labor, to liberate latent resources and bring about an improvement in the ore produced. All this goes to show the great prospects especially as regards production and export, which the U.S.S.R. manganese industry has before it.

In conclusion it should be said that at Chiatura there are the largest deposits in the world of so-called peroxide ore, which is used in the chemical and electrical industries. Peroxide ore is found at Chiatura containing 80 to 90 per cent and even a higher percentage of MnO^2. This has been exported for some years to Europe and America where it has gone a long way towards meeting the demand for this type of ore in the chemical and electrical industries of the various consumer countries.

Coal Liquefaction in Japan's Fuel Policy*

No discussion of the oil situation in Japan in recent years is complete without a study of the coal liquefaction industry which has developed under strong official protection. The possibilities of coal liquefaction have been receiving the closest attention of the Japanese Government as one of the cardinal factors for the solution of the national liquid fuel problem. Japan's national fuel policy is determined by the fact that the Empire supplies only about ten per cent of its petroleum needs, and would be seriously embarrassed should there be any interference with imports. Similarly, the annual gasolene consumption of Japan, exclusive of naval requirements, reaches roughly 3,000,000 tons, of which Japan supplied about 300,000 tons by domestic production. Nearly 90 per cent, valued at Y.130,000,000, is imported from abroad. Estimating the annual natural increase of the Empire's gasolene consumption at 10 per cent, her annual demand in 1943 will exceed the 5,000,000 ton mark. Accordingly, official and private organizations have been endeavoring to develop subsidiary emergency supplies.

For some time emphasis was placed upon the use of fuel substitutes, such as charcoal gas and alcohol, for internal combustion engines. Latterly, that emphasis has been transferred to coal liquefaction and shale oil distillation. For the past few years, the South Manchuria Railway Company and the Mitsubishi and Mitsui interests have been operating trial coal liquefaction plants. The Government itself also drew up a plan for the construction of a model liquefaction plant, for which the Ministry of Commerce and Industry set aside Y.15,000,000 in the 1936-7 national budget. All the present liquefaction enterprises, both governmental and private, however, are small and experimental in scale, the plant operated by the South Manchuria Railway Company and the government model plant being limited to an annual production of 30,000 tons each according to the plan at present in operation.

The Latest Plan

The latest government plan which is being drafted by the experts of the Ministries of Commerce and Industry, War, Navy, Finance, and Overseas Affairs, and the Cabinet Board of Resources, is on a much more comprehensive scale. It calls for the establishment of a giant holding company designed to finance various liquefaction projects, both civil and governmental, to be capitalized at Y.100,000,000 at the start. Upon formal organization, this company will float debentures to the amount of Y.200,000,000, while the Government, according to report, plans later to increase the capital of the company to Y.500,000,000.

Through the plants financed by this company, the Government plans to increase the annual gasolene production in the liquefaction industry to 1,500,000 tons within the coming five years. According to present plans, the increased revenue from the increased import tax on gasolene and the new gasolene consumption tax, included in the recent wholesale tax increase program, will be used as the principal resources for the enterprise.

The details of the plans are as follows :

(1) *Organization of the Company.*—The proposed holding company shall be a semi-Government organization capitalized in the beginning at Y.100,000,000, of which Y.50,000,000 will be subscribed by the Government and Y.50,000,000 by private organizations.

(2) The Government shall guarantee an annual dividend of five per cent on investments from private sources. There shall be no dividends on government investments until profits reach five per cent on the total invested capital.

(3) Against the capital investment of Y.100,000,000, debentures shall be floated or loans raised to the amount of Y.200,000,000. The capital of the company shall be increased, according to the present plan, to Y.500,000,000 within five years.

(4) The present company shall remain as a holding company to function as a medium for Government investment in private enterprises, and shall not directly engage in industrial enterprises on its own responsibility.

(1) *Production Plan.*—The annual production of gasolene and heavy oil from coal shall be 1,500,000 tons.

(2) The coal needed for such an output, estimated to amount to 7,900,000 metric tons annually, shall be provided from increased production at sources in Japan proper and territories under Japanese influence.

This Government drive has stimulated many industrialists to take to liquefaction activities. The Mitusi and Mitsubishi interests, for example, have both decided to increase the scale of their coal liquefaction activities referred to earlier. Some time ago, the Mitsui interests built a trial liquefaction plant after the Fischer method in the Miike Dyestuff Factory, a Mitsui affiliate, in Ohmuta, Kyushu, under the supervision of Mr. Shiro Watanabe, former chief of the coal section of the Mitsui Bussan K.K., who had been sent to Germany to study the Fischer method in 1935. Encouraged by successful trials and experiments at the Ohmuta plant, the Mitsui leaders have planned to form the Mitsui Coal Liquefaction Company capitalized at Y.20,000,000 with an initial annual program of production of from 35,000 to 50,000 tons of gasolene. A complete Fischer plant has already arrived from Germany, ready to be installed in the Ohmuta factory.

Should things progress smoothly, the Mitsui interests contemplate increasing the capital of the proposed company to Y.50,000,000 within two years and constructing another liquefaction plant in Hokkaido with a view to increasing the annual output to 100,000 metric tons. During the first stage coal will be furnished by the Miike Coal Mine in Kyushu, which is controlled by the Mitsui interests, and hydrogen by the Miike Hydrogen Manufactory, affiliated to the coal mine.

Mitsubishi First in Field

The Mitsubishi interests took up consideration of the liquid fuel problem prior to the Mitsui organization. About two years ago, the Mitsubishi Mining Company conducted low temperature carbonization of coal on a large scale at the company's plant in Hokkaido. In the early part of 1936, this company built a trial liquefaction plant with a daily capacity of five metric tons at Ohi near Tokyo. Results at the Ohi plant are reported to have been encouraging enough to induce the leaders of the Mitsui interests to decide to take up the liquefaction enterprise on an industrial scale. Although details are not as yet to hand, it is reported from authentic sources that the Mitsubishi interests have already obtained a Government guarantee of a state subsidy for their venture in liquefaction.

Despite the shift of emphasis in its policy to liquefaction, the Government has not relaxed its efforts to promote the production of fuel subsitutes, as shown by the terms of the Artificial Petroleum Manufacturing Bill which was presented to the last session of the Imperial Diet. According to the present bill, which was drafted by the Ministry of Commerce and Industry, the Government is to adopt a licence system for all artificial petroleum manufacturing projects including coal hydrogenation, low temperature carbonization and petrol synthesis. The minimum annual production capacity of artificial petroleum plants qualified for Government permission was fixed at 50,000 metric tons each in the bill. Such plants, duly licensed by the Government, will be exempted from income-tax, business profit tax and provincial taxes for a certain period, tentatively fixed at 10 years.

Losses Covered

All the artificial petroleum products will also be exempted from consumption tax, according to the provisions of the bill. It is also pointed out in the bill that the Government will grant state subsidies to cover all losses emanating from differences between the production cost of natural petroleum and artificial petroleum for a certain period, tentatively fixed at seven years.

Mixture of alcohol with gasolene was another factor in Japan's struggle with " fuel " difficulties in 1936. In the latter part of the year, the Government decided to build 80 absolute alcohol plants in

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**Japan Advertiser Annual Review*

Japan proper on a seven-year plan. The plan calls for the construction of from seven to nineteen alcohol plants annually between 1937 and 1943, as follows:

Year	*Number of Plants*
1937	7
1938	8
1939	9
1940	10
1941	12
1942	15
1943	19
Total	80

Sites for these alcohol plants will be selected from among the prefectures under the jurisdiction of the seven provincial monopoly bureaux, Tokyo, Sendai, Kumamoto, Kohriyama, Kanazawa, Osaka and Hakodate, because of the monopoly system which the Government plans to adopt for the sale of alcohol from this year.

TABLE I.—JAPAN'S IMPORTS OF CRUDE AND HEAVY OILS

(in kilometers : Value in Y.1,000)

	1936		*1935*		*1934*	
Origins	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Manchoukuo	72,520	1,692	53,490	1,311	49,217	1,355
British Borneo	318,679	9,491	186,078	5,465	146,906	4,446
Dutch India	508,822	15,501	404,562	11,864	266,970	7,537
Asiatic Russia	—	—	2,317	68	268,878	8,078
Russia	5	0.1	1,373	33	—	—
U.S.A.	2,878,756	99,348	2,610,706	81,336	1,856,160	54,475
Other	133,605	3,656	219,289	6,749	228,173	6,592
Total	3,912,387	129,688	3,477,815	106,826	2,816,304	82,483

By a bill which was presented for approval at the 70th session of the Diet, the Government attempted to legalize the compulsory mixture of alcohol. This Alcohol Mixture Bill, drafted by the Ministry of Commerce and Industry, aims at consummating the "alcohol side" of the national fuel policy in concert with the Alcohol Monopoly Bill prepared by the Ministry of Finance. According to its provisions, domestic refiners and importers of gasolene are to be required to mix a certain percentage of fuel alcohol with gasolene which they sell or use, such percentage ranging from three to 20 per cent.

Oil Companies Merge

If 1935 was the year of numerous changes in the different oil activities resultant from the operations of the Petroleum Business Law, 1936 was the year for the readjustment of these changes. The establishment of the Joint Petroleum Company, the organization of the Kerosene Union and the Government campaign for the completion of facilities for substitute fuel, may be taken as three cardinal events in the domestic petroleum world which took place during 1936 in connection with such readjustment. The Joint Petroleum Company (Sekiyu Rengo Kabushiki Kaisha) was established in March, 1936, by the seven leading companies, Japan Oil, Kokura Oil, Mitsubishi Oil, Mitshbishi Shoji, Hayama Oil, Aikoku Oil and Nisso Oil. This company has since been playing an active part as a powerful controlling organ. The Kerosene Union, organized in July, 1936, was the culmination of the efforts on the part of the six member companies of the Joint Petroleum Company to stabilize the kerosene market.

A dull start was made in the gasolene market in 1936 owing to the severe cold and heavy snow at the beginning of the year. The rise in the price of American crude oil and the advance in the trans-Pacific freight rates, owing to the Italo-Abyssinian hostilities, also served to aggravate the profit situation of domestic oil companies. Consequently, these companies petitioned the Ministry of Commerce and Industry and obtained its permission to raise the gasolene price by five per cent a gallon on May 1.

Kerosene Demand Rises

Kerosene made an unexpected rise in 1936. At the beginning of the year, very few people believed that there would be any increase in demand, and many companies planned to resort to dumping or mixture with light and heavy oils in order to dispose of surplus stock.

The rise of various domestic industries under the impetus of "military" inflation, the increased use of motorized agricultural implements owing to better crops, the sharp rise in the number of small-sized fishing motor-boats, the advance of the liquid insectifuge manufacturing industry and the bigger consumption by motorists for mixture with gasolene, however, combined to stimulate a big demand for kerosene as the year advanced. As a result, the official kerosene sales quota, allotted by the Ministry of Commerce and Industry for the fourth quarter, October to December, proved to be about 1,500 kilo-liters short of demand.

The kerosene market, naturally, continued strong in tone with repeated advances in price. Light oil and machine oil followed suit, though they began the year more or less on a weaker tone. Steadily gaining ground as the year advanced, their market price was 70 sen higher at the end than at the beginning of the year. Heavy oil was no exception to the improving trend, with the 1936 consumption exceeding that of 1935 by more than 10 per cent.

Crude Production Increases

Domestic production of crude oil by principal oil fields in Japan during the first ten months of 1936 is reported by the Ministry of Commerce and Industry to have totalled 1,737,074 koku, which was an increase of 26.9 per cent over the 1,368,682 koku produced during the corresponding period a year ago. Month-by-month production of crude in 1935 and 1936 is compared below:

MONTHLY CRUDE OIL OUTPUT

(In koku)

Months	*1936*	*1935*
January	161,369	152,523
February	145,751	133,380
March	172,719	144,255
April	170,609	147,318
May	178,433	135,447
June	174,317	126,684
July	181,256	129,046
August	194,308	133,813
September	182,113	127,179
October	176,198	138,975
Total	1,737,074	1,368,682

Comparative annual production figures on the basis of the Ministry of Commerce and Industry statistics follow:

JAPAN'S CRUDE PRODUCTION

(Metric tons)

1925	265,567
1926	257,535
1927	247,143
1928	285,415
1929	291,100
1930	277,609
1931	280,877
1932	241,525
1933	205,105
1934	210,748
1935	289,000
*1936	370,220

Production in the oil fields leased by the North Saghalien Oil Company from the Soviet Government in North Saghalien last year is estimated to have reached 230,000 metric tons on the basis of the actual production during the first nine months of the 1936 oil year, April, 1936 to March, 1937. Production during the nine months under review totalled 193,207 metric tons compared to the 177,200 metric tons which the company was scheduled to produce during the whole 1936 oil year. Including the production in North Saghalien, the total production of crude in Japan during 1936 is estimated to amount to about 565,000 metric tons.

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*Including estimates.

General view of substation in the Khardah Jute Mills showing part of the 22,000-volt switchgear, two 1,000 kva. transformers, two 5,000 kva. transformers, high-tension and low-tension switchboards and 75 kw. motor generator sets driven by Kosfi motors

The Electrification of the Khardah Jute Mills

By F. WATSON, Manager of the English Electric Company's Calcutta Branch

THE world production of jute is virtually a monopoly of Bengal, yet until 50 years ago only a very small quantity of finished cloth was manufactured in India, and that principally on hand looms. During the latter half of the last century, however, rapid development of the natural resources of Bengal took place, and with the growing demand for jute products a large number of mills sprang up around the Bengal capital. To-day more than half of the Indian output of jute is consumed in the local mills.

Bengal possesses a vast network of natural waterways in the jute-growing districts, and this provides an extremely cheap method of transporting the raw material, with the result that practically all the jute mills were built on the banks of the River Hooghly. To-day there are approximately 80 jute mills on the river within a distance of 20 miles north and south of Calcutta.

The majority of these mills are now over 30 years old, but were originally laid out along the lines of the latest practice then ruling in Dundee. They were generally driven by two large horizontal slow-speed steam engines, one for the mill and the other for the factory, the drive to the line shafts taking the form of a series of endless ropes in a rope alleyway which extended the width of the mill and between the mill and the engine room. The steam-raising plant generally consisted of batteries of Lancashire type boilers. It will readily be understood that in the fierce competition which exists at the present day these methods of power generation form a serious obstacle to cheap production. Furthermore, such

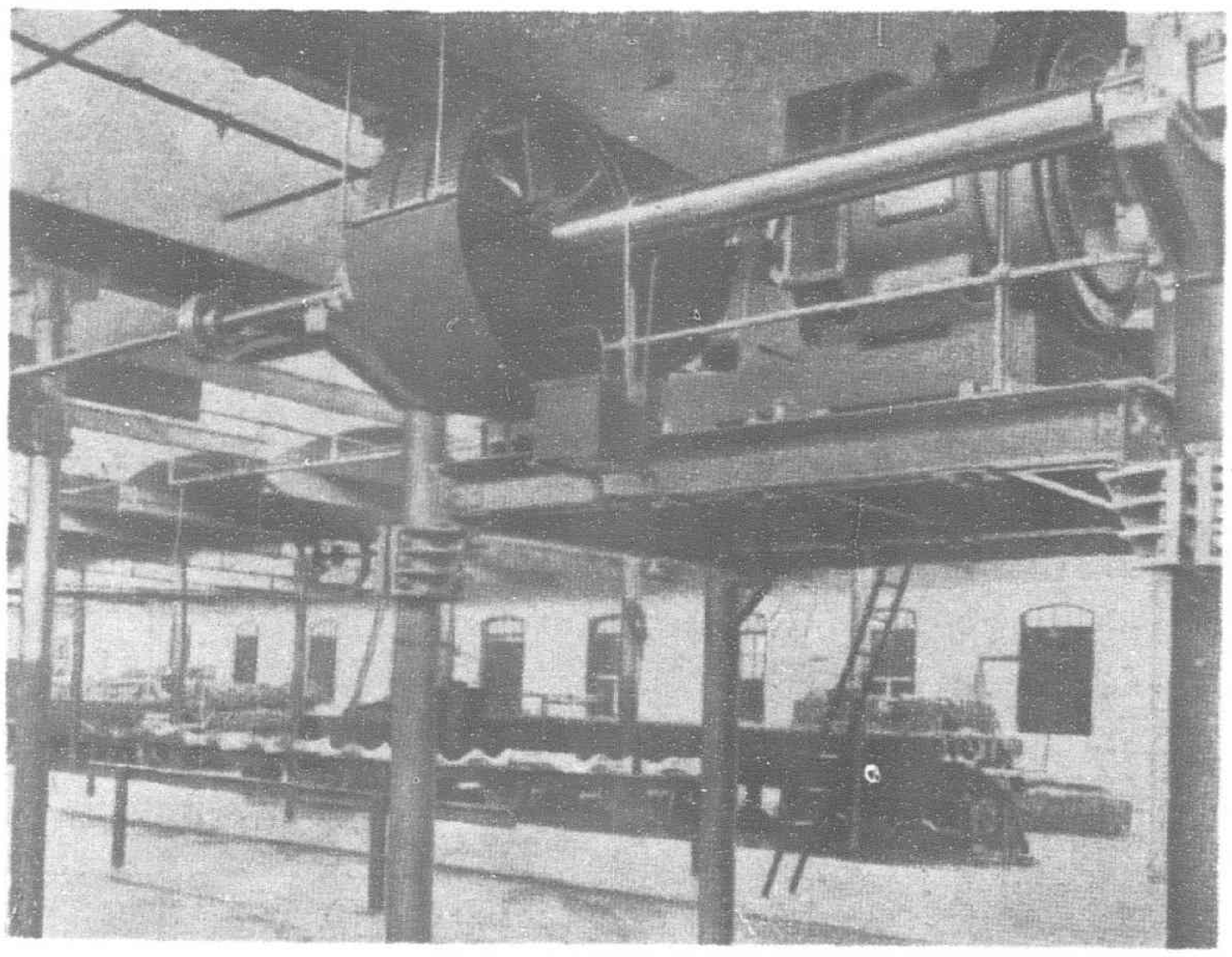

Fig. 1.—300 h.p. 3,300-volt pipe-ventilated slipring induction motor driving softeners, teaser and breaker cards

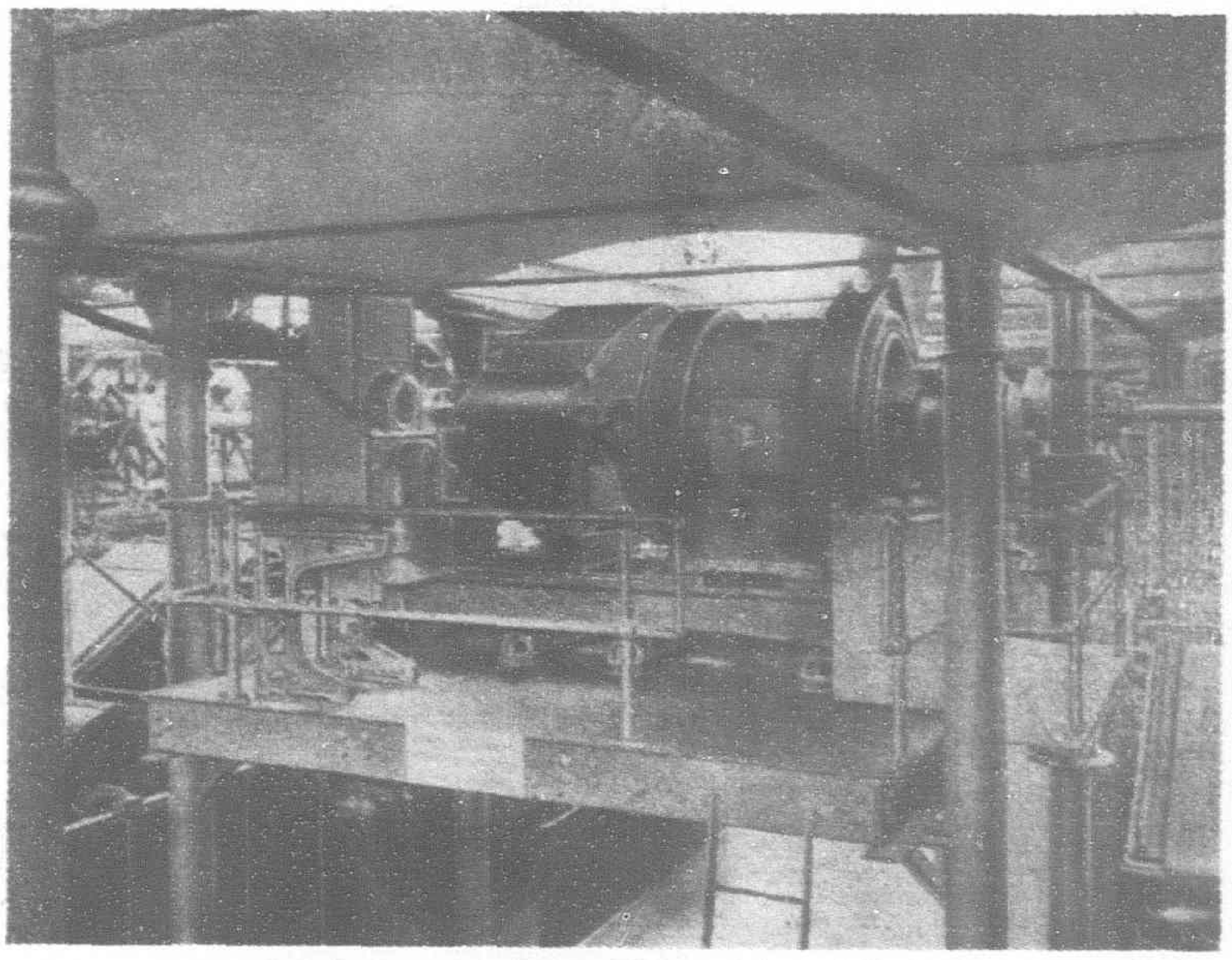

Fig. 2.—300 h.p. 3,300-volt pipe-ventilated slipring induction motor driving breaker, inter-finisher and finisher cards

plant has practically reached the end of its useful life, and not only are the fuel and steam consumption figures very high, but maintenance charges are naturally becoming unduly heavy.

The need for the strictest economy in working in Calcutta is also enforced by other considerations. Until recently practically all the larger mill owners were members of the Jute Manufacturing Association, a body which includes in its aims the avoidance of overproduction and unnecessary competition between manufacturers. During the last few years, however, the number of smaller non-association manufacturers has grown and to some extent the objects of the Association have been defeated. To meet this competition, therefore, various measures were taken by working longer hours, etc. This has had the result of lowering the price of the finished article and has made it still more imperative for the owners of the older factories to seek some alternative and more economical method of driving their mills.

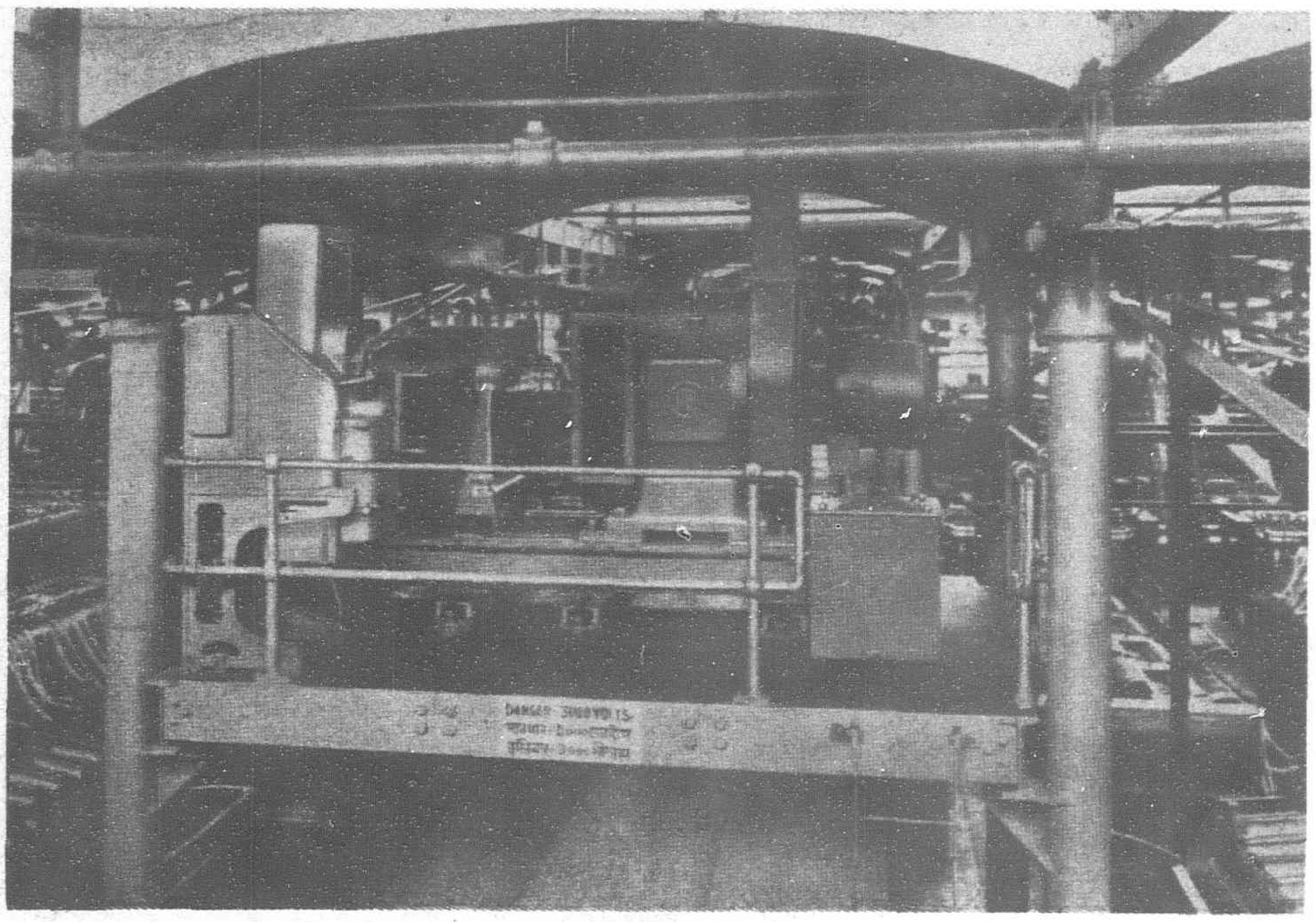

Fig. 3.—200 h.p. 3,300-volt pipe-ventilated slipring induction motor driving overhead line shafting for roving machines

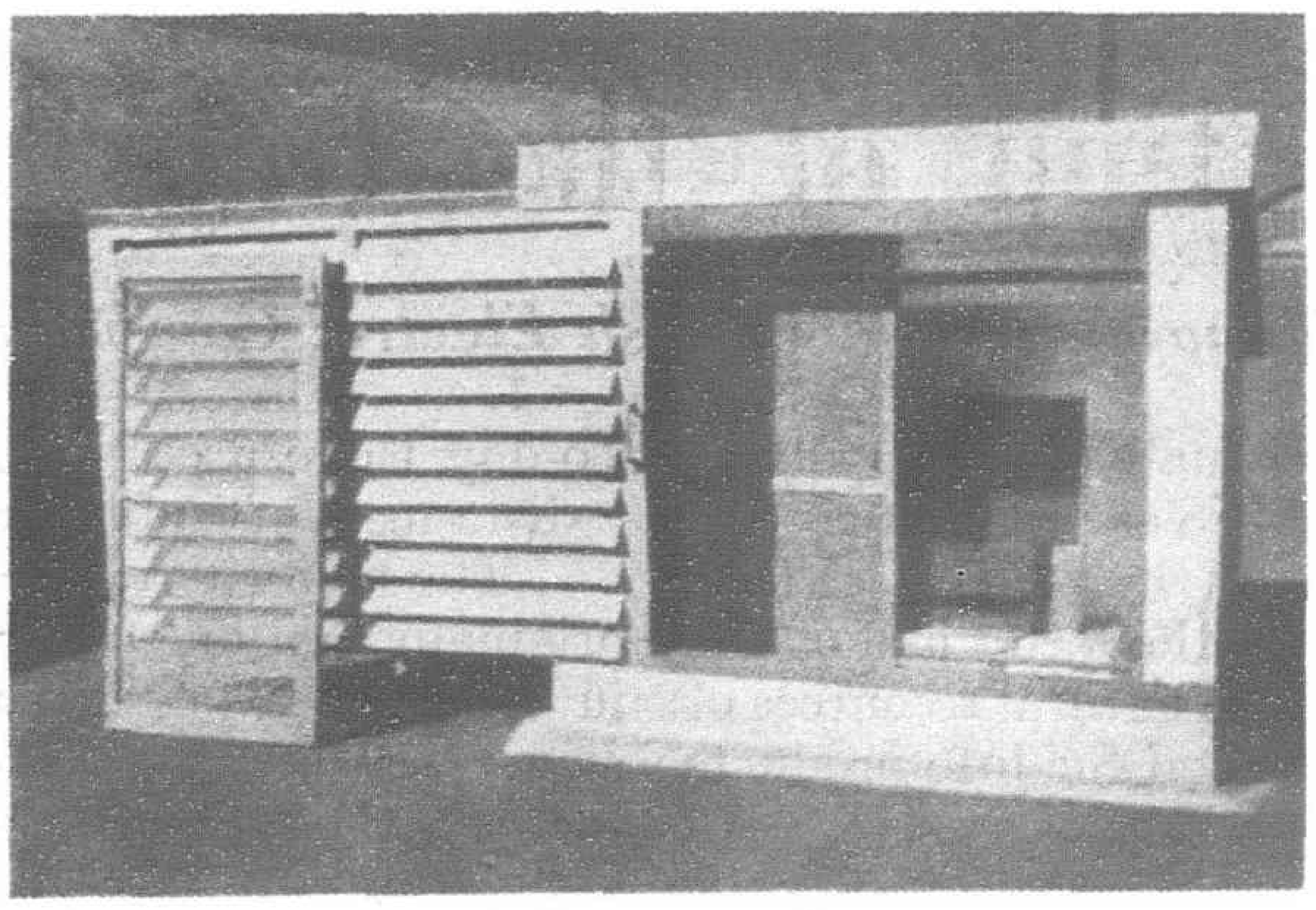

Fig. 4.—Roof shelter, for pipe-ventilated motor air intake, showing one gauze dust screen removed and sliding louvre door open

The three principal alternatives are :—

(1) The purchase of modern higher pressure water-tube boilers and steam turbine plant, the latter being provided with suitable reduction gears for coupling to the existing rope drives and with means of passing out from the turbine a sufficient quantity of steam for the process work in the mill.

(2) As above, but with the turbine arranged to drive an alternator which supplies power to motors driving the mill machinery either individually or in groups.

(3) The purchase of electric power from an outside source, together with the installation of motors as in the case of (2).

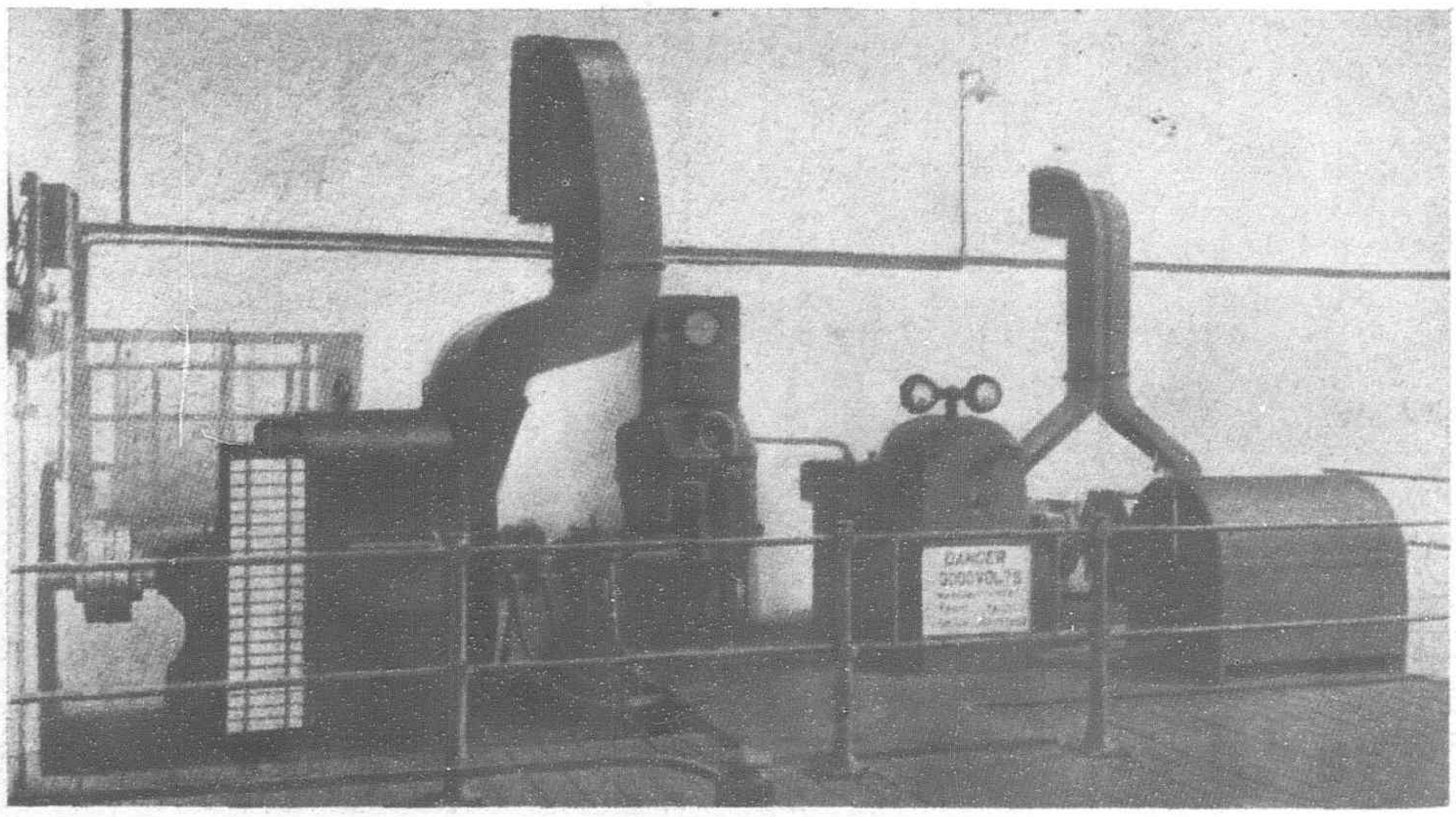

Fig. 5.—450 h.p. 3,300-volt asynchronous-synchronous motor driving line shafting for spinning machinery. The transformer and automatic motor generator set for motor excitation may be seen in background

Khardah Jute Mills

The Khardah Jute Mills consist of identical mills arranged side by side and form what is believed to be the largest mill under one roof on the river.

Messrs. Anderson, Wright & Co., the Managing Agents of the Khardah Jute Co., gave this problem very serious consideration and found that, like a number of other mills, their power plant, which was originally installed in 1896, was reaching the limit of its economical life, whereas the mill machinery itself was in a much better condition. Both of the first two alternatives previously mentioned would, of course, entail very heavy capital expenditure, and it was eventually decided to take energy from the Calcutta Electric Supply Corporation, who were able to offer extremely attractive rates for the amount of power which the mills would consume.

After considering alternative schemes, the order for the complete conversion of the two mills at Khardah was awarded to the English Electric Company, who have for many years made a close study of the requirements peculiar to the jute manufacturing processes, which in India are considerably aggravated by local conditions.

Of these, mention may be made of the very high temperature and humidity conditions which exist over a large period of the year, and shade temperatures as high as 115 deg. F. and humidity approaching saturation are quite common. This means not only that all the electrical materials must be liberally rated to ensure a reasonable temperature rise, but the ventilation of the machines must be most carefully designed to avoid hot spots, which, in conjunction with the high ambient temperatures, would certainly prove injurious to the insulation. In addition, owing to the high water content of the air, the insulation must be of the highest quality and so treated that it is impervious to moisture.

Another factor which calls for serious consideration is the difficulty in obtaining skilled labor for the operation of the electrical machinery which, therefore, must be foolproof and extremely robust.

Layout of the Mills

In the Khardah Jute Mills numerous other difficulties existed, but due to the careful consideration of all the details of the scheme in the initial stages, in consultation with the Mill Management, they were satisfactorily overcome.

One of the features of this conversion is the general disposition of the various motors, which are erected on steel platforms in the center pass of each mill. In a number of mill conversion schemes, the motors are installed in the rope alleyway at the mill ends. The principal advantage of this arrangement is that after the conversion the motor alleyway can be effectively walled in, making it a simple matter to exclude dust and fluff and to utilize ordinary enclosed ventilated motors. The possibility of doing this was investigated at Khardah, but a number of factors were found which militated this arrangement. By placing the motors in the center of the mill, however, an important advantage is secured in reducing very considerably the speed variation along the line shaft, which may assume serious proportions in the case of a long line driver at one end. An impression of the pless at form construction can be obtained from Figs. 1 and 2.

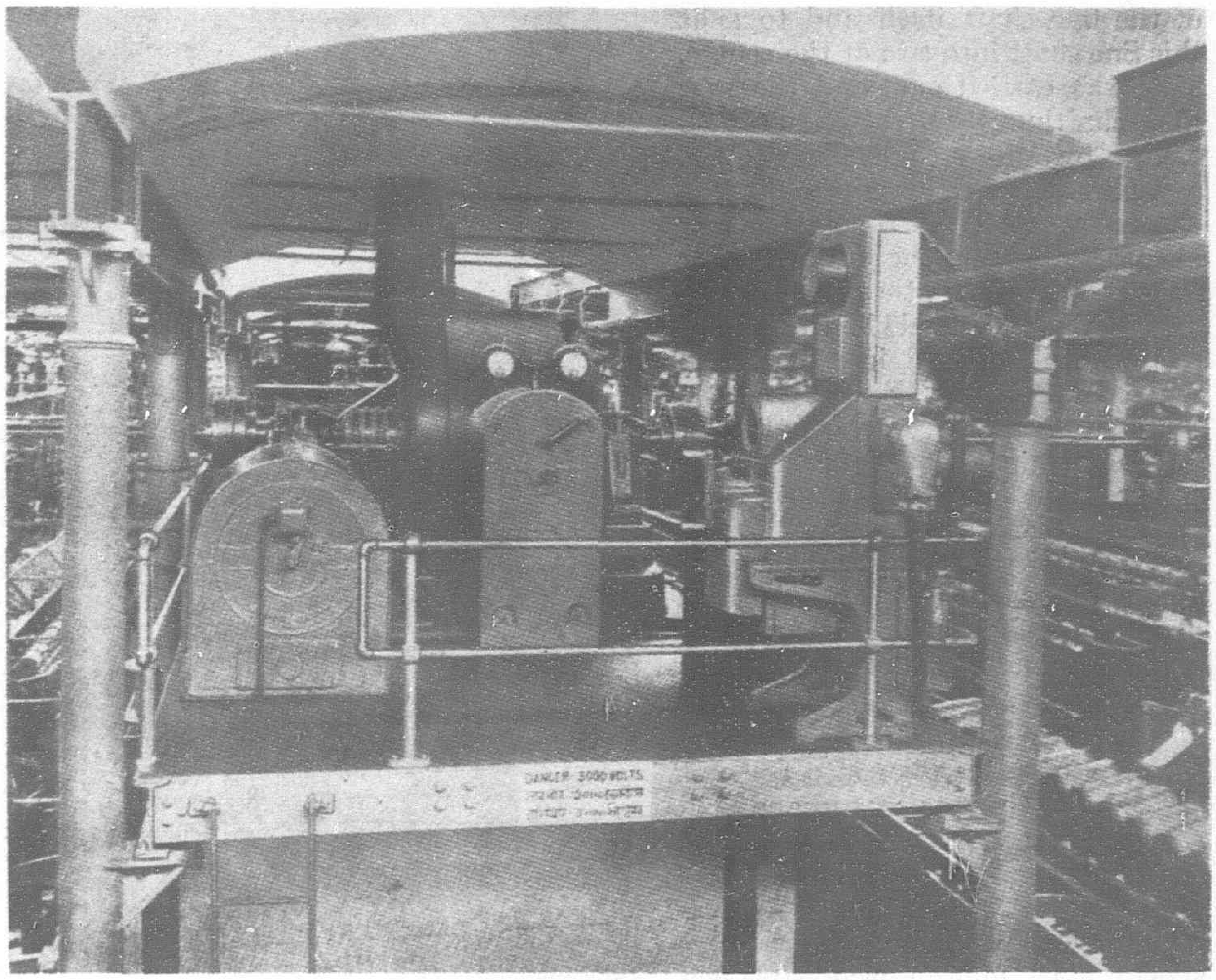

Fig. 6.—450 h.p. 3,300-volt asynchronous-synchronous double-ended motor driving line shafting for spinning machinery

It will be noticed that although the roof is somewhat low and sufficient clear working head room had to be provided underneath the platform in the mills pass, there is comfortable head room for working and ample access to the motors and their control gear on the platform. The platforms were fabricated in India and considerable care was taken to prevent vibration. Whenever possible, the existing cast-iron roof columns were utilized, and these were augmented by additional columns with cast-on brackets where necessary.

Owing to the presence of fine jute fibres and dust in the atmosphere, especially at the preparation end of the mill, all the motors, except those in the factory, were arranged for pipe ventilation. The inlet air is drawn through a short length of ducting from the roof, and the intake of this duct is protected by light masonry shelters, which are provided with large area gauze screens to exclude the dust and, as a further protection against the heavy driving monsoon rains, by means of louvres in the sliding door. The ducts are shown in Fig. 3, and Fig. 4 shows the air intake on the roof.

All the main drives in the mill, except the spinning, are carried out by means of Renold inverted tooth chains; the motors run at 750 r.p.m. (syn.), the speed being reduced to either 137 r.p.m. in the mill or 150 r.p.m. in the factory. Generally speaking, 4-ft. chain centers have been employed, the drives being totally enclosed and force lubricated by means of a pump and sump. The general arrangement can be seen from the illustrations. It will be noticed that the center length of mill shafting has been replaced by a length of increased diameter shaft on which the solid chain wheel has been fitted.

With the object of obtaining a large degree of interchangeability and to reduce the quantity of spares to be carried, the motors were standardized as far as possible, and actually there are only five different sizes of motors employed in both the mills. The different motors comprise the following :—

Seven 450 h.p. asynchronous-synchronous motors for the spinning drives (one spare).
Six 300 h.p. slipring induction motors for driving softeners, breakers, interfinisher and finishing cards.
Six 200 h.p. slipring induction motors for driving softeners, teasers, drawings, rovings, etc.
Nine 150 h.p. slipring induction motors for driving looms, calenders and finishing machinery.
Nine 50 h.p. slipring induction motors for driving press pumps, sewing departments and workshops.
The horse-power of the motors installed aggregates 7,500 h.p.

In the case of the motors for driving the spinning line shafts a number of considerations had to be taken into account. One of the main lines (E. shaft), running at 210 r.p.m., was arranged for double-belt driving to the frames, and the calculated load on the shaft was 830 h.p. If a single motor were used, it would necessitate a somewhat larger size than was considered desirable. It was further appreciated that with the more even torque that could be obtained from the electric drive, the spinning speeds could be increased. As the latter would, in any case, involve a change in the belt drives, it was decided to go still farther and raise the speed

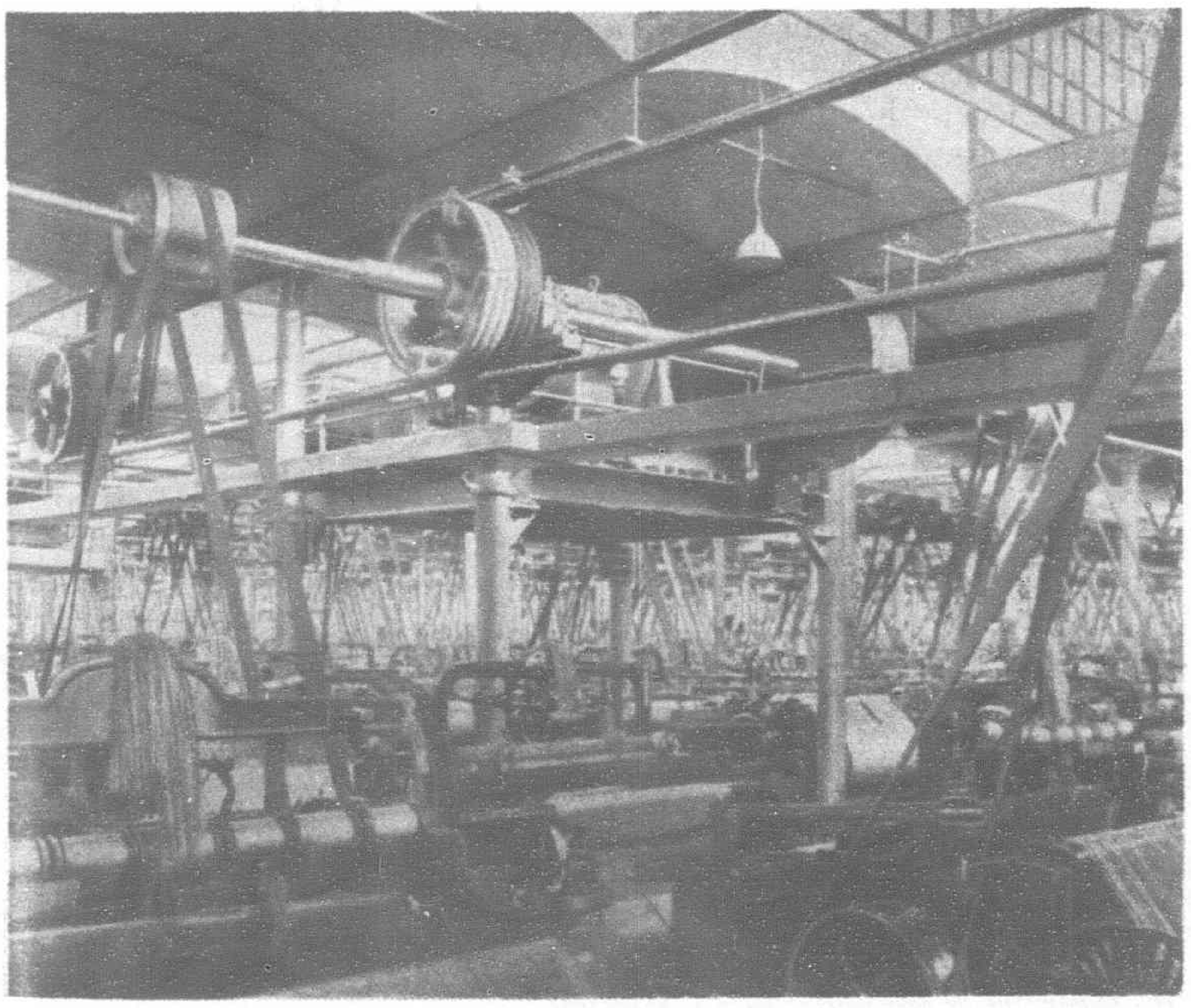

Fig. 7.—150 h.p. 3,300-volt slipring induction motor driving loom shafting. The Dick-Balata subsidiary drive to adjacent line shafts can also be seen

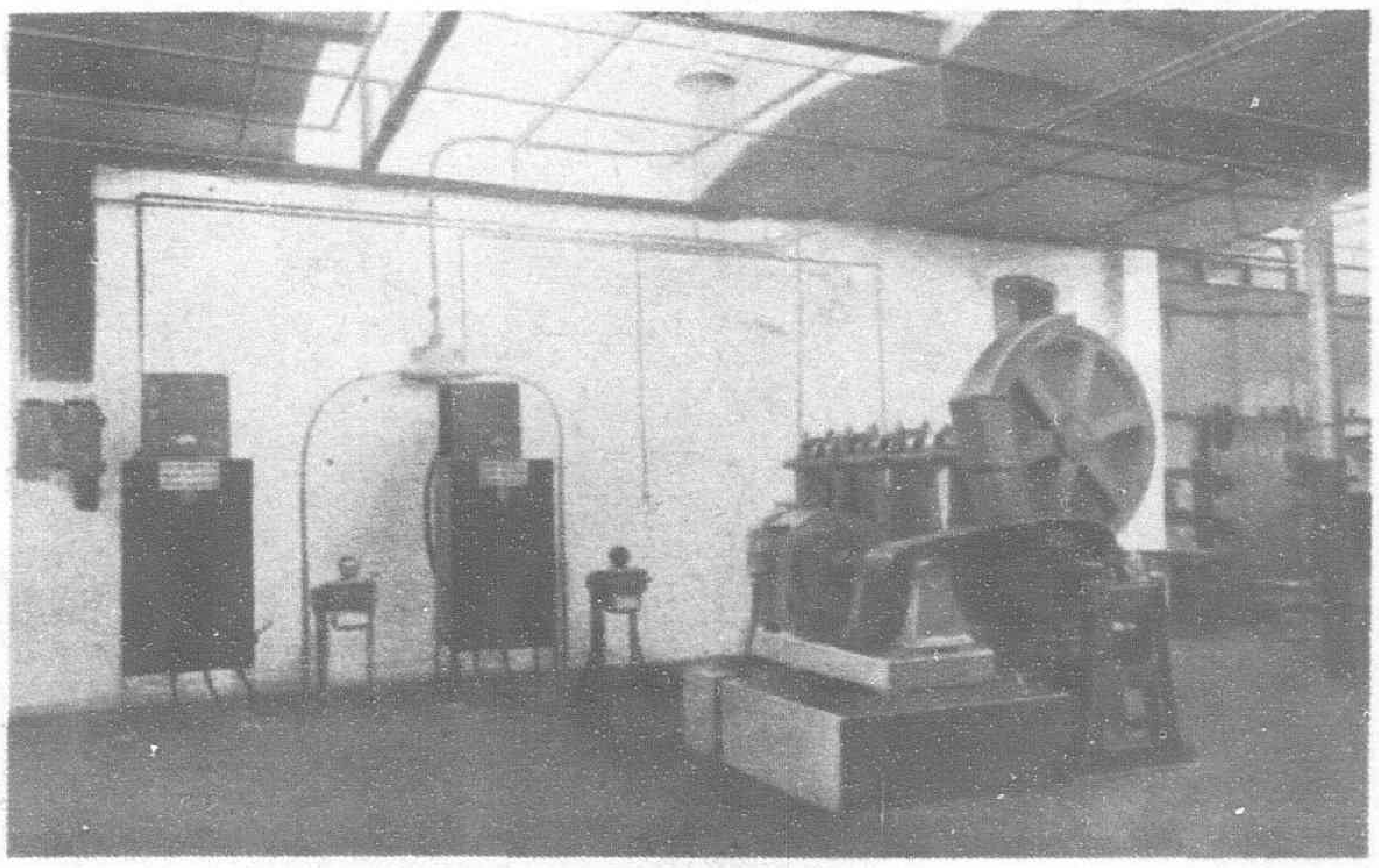

Fig. 8.—50 h.p. 400-volt slipring induction motor driving press pump. Contactor type control gear and starters for two similar sets may be seen in background

of the line shaft itself and to split this line shaft into two at the center. This was carried out, and the new line shafting was driven at 500 r.p.m. by direct-coupled 450 h.p. asynchronous-synchronous motors, one being erected in the center pass in a similar manner to the other motors, while the other end-driving motor was installed in the engine room, as illustrated in Fig. 5. In the case of the "F" spinning line shaft in each mill, only single belt drives were used, taking half the power of the E. line. This was met by using the same type of motor, which was provided with double shaft ends, on a center pass platform and direct-coupling it to the line shaft at each end, as shown in Fig. 6.

The Calcutta Electric Supply Corporation rates take into account not only maximum demand and load factor, but impose a surcharge on any installation having a power factor worse than .95 lagging. For this reason the 450 h.p. asynchronous-synchronous motors were designed to run at a leading power factor which would enable the figure of .95 to be obtained on the whole installation. The degree of power factor correction on these motors is controlled by the exciter regulation, so that actually the optimum value which gives the best performance and efficiency can always be obtained.

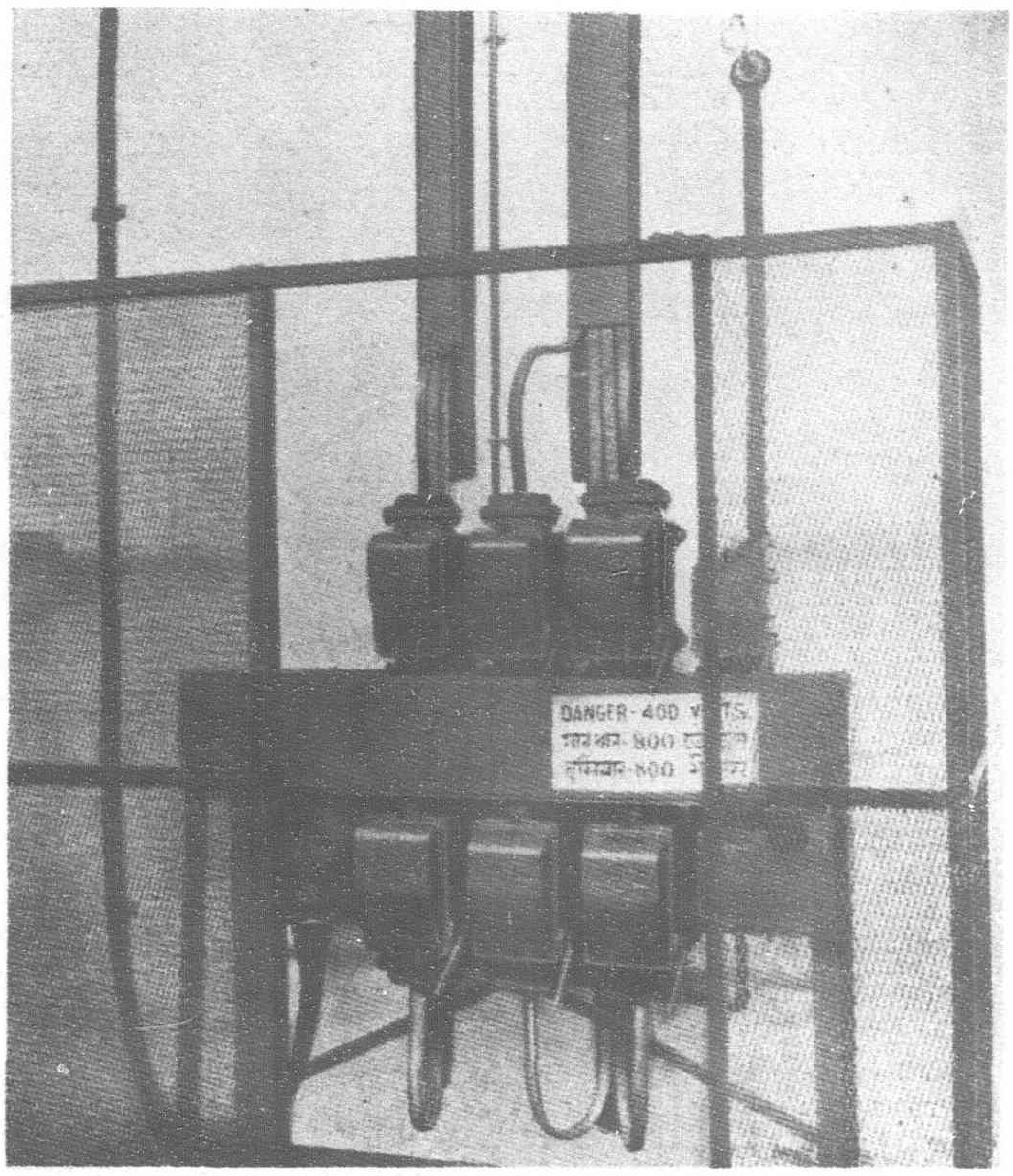

Fig. 9.—Combination fuse switchboard for mill lighting distribution

Owing to the space limitations previously referred to, the exciters were not mechanically coupled to the motors, but were direct-coupled to suitable squirrel-cage motors. These small motors took their supply from an auxiliary transformer stepping down pressure from 3,300-volts to 400-volts. The transformers are connected on the high tension side to the main motor stator control, so that when the latter is closed the exciter set automatically starts up and is switched into the rotor circuit when the main motor is up to speed.

In the case of the loom drives at the factory end, 150 h.p. induction motors were used, each driving three line shafts, the center-shaft being chain-driven from a platform-mounted motor and the two shafts on either side, at approximately 11 feet centers, being driven by "Dick-Balata" vee-shaped belts from a double pulley on the center shaft. The arrangement of this drive can be seen from Fig. 7.

An interesting application is the method employed for driving the press pumps. Originally these were belt-driven with fast and losse pulleys under the control of the press operatives. These were rearranged for a chain drive from a 50 h.p. slipring induction motor mounted on a compact masonry plinth close to the pump bedplate. The motors are controlled by automatic step by step contactor type starters. The press pumps are under the complete control of the operators by means of stop and start push buttons mounted in convenient positions.

With the method of pressing employed in the mills the motors are required to stop and start very frequently (as much as 20 times an hour), and the operators are not skilled men, being usually of the coolie class. It will be appreciated, therefore, that this automatic control affords a considerable saving in time and avoidance of overloading, due to the theoretically correct starting time which the automatic starters ensure. The drives and contactor panels are illustrated in Fig. 8.

Mill Lighting

The contract also included the changing over of all the lighting circuits in the two mills from D.C. to A.C., the previous supply having been taken from small steam-engine-driven generators, which were dispensed with in the conversion. The original mill distribution feeders were incapable of dealing with the much heavier fault kva. made available by the A.C. supply, and new ironclad switchboards fitted with high rupturing capacity combination fuse switches were installed. One of these switchboards is shown in Fig. 9. The metal casing over the lead-covered cables was fitted in order to comply with the Indian Electricity Rules.

Sub-Station

A general view of the sub-station is shown in accompanying illustration and it will be seen that a building which was originally part of the mill has been used ; the plant, however, has been disposed of in a manner resulting in economical cable runs, but at the same time giving full access to all the gear.

The supply is brought into the sub-station by duplicate cables at 20,000-volts, and is taken from the Supply Company's metering panel to the incoming panel of the main mill switchboard. This consists of a five-panel board of compound filled O.L.E. 2A type switch panels, illustrated in Fig. 10, with a rupturing capacity of 350,000 kva. Feeders are taken to four transformers, two of 5,000 kva., stepping down to 3,300-volts and giving supply to all

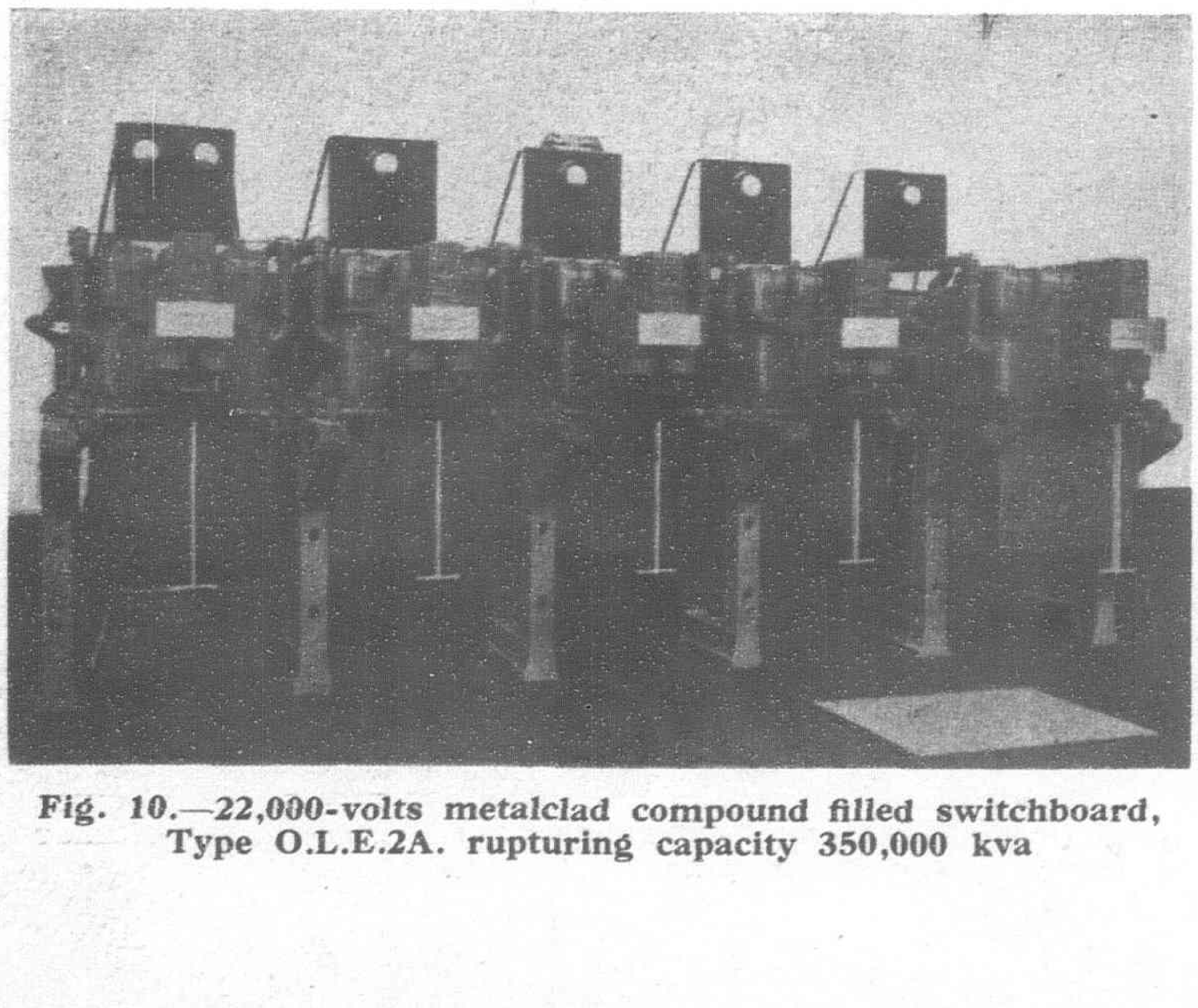

Fig. 10.—22,000-volts metalclad compound filled switchboard, Type O.L.E.2A. rupturing capacity 350,000 kva

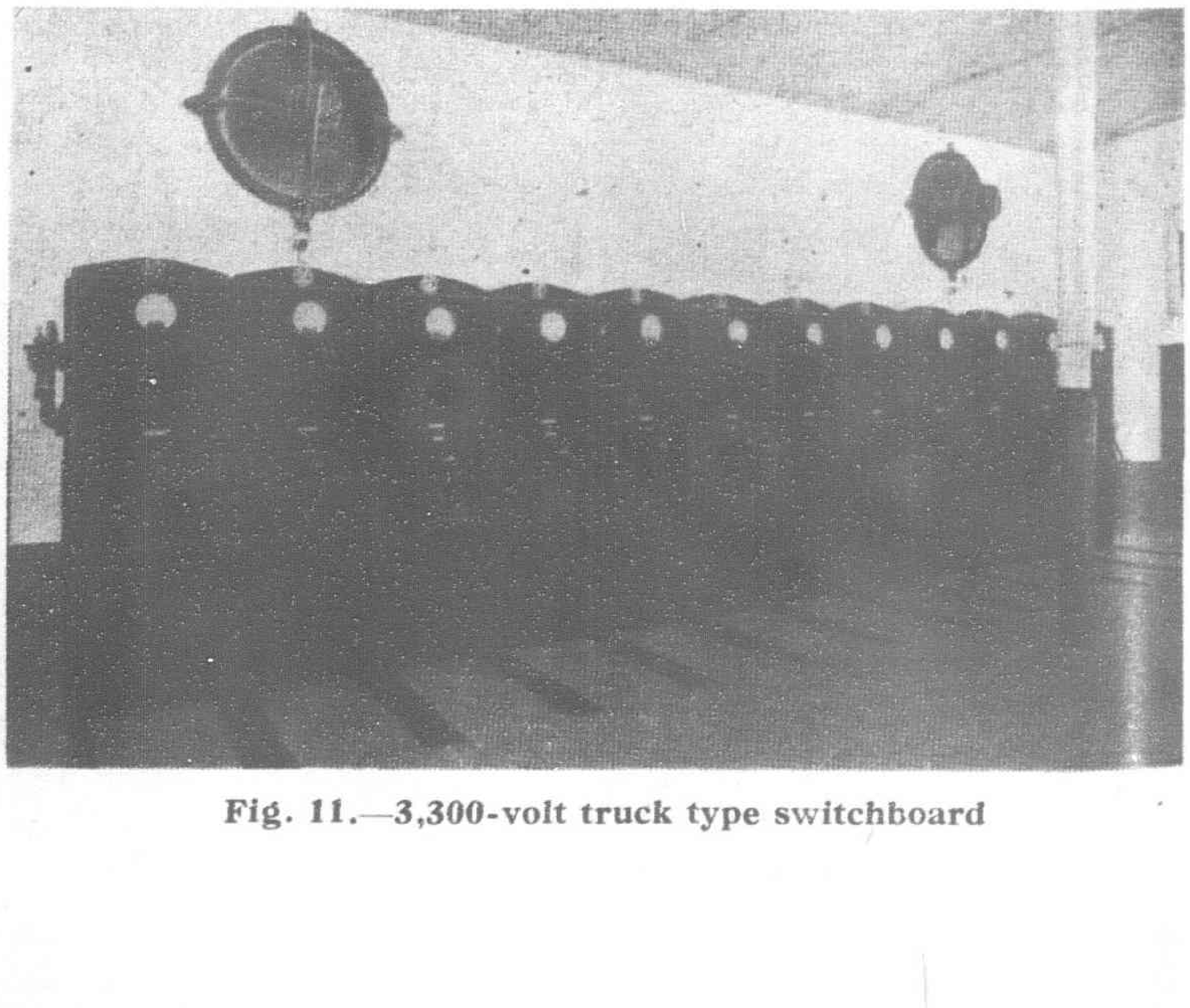

Fig. 11.—3,300-volt truck type switchboard

the mill motors at 150 h.p. and upwards, and two smaller transformers rated at 1,000 kva., each stepping down to 400-volts to supply all the smaller motors. The neutral point on the L.T. side is brought out to provide the A.C. lighting supply for the mills.

Owing to the cost of converting all the D.C. fans and other apparatus in the residential quarters and certain other small circuits, such as the electrically operated jetty cranes, it was decided to retain D.C. for these. This was done by utilizing three of the existing generators, which were disconnected from the original steam drive and installed in the sub-station and direct-coupled to three 120 h.p. Kosfi motors. These motors serve to take care of the power factor at night time and at periods when the asynchronous-synchronous motors in the mill are not working.

Each of the different size transformers is capable of meeting the full load demand of the mills, and there is, therefore, a 100 per cent standby in this respect.

As elsewhere in the mill, the roof of the sub-station was very low, and a modification was, therefore, made to the center. Lifting beams were erected at such a height as to enable the transformer cores to be lifted clear of the tanks. Also, owing to the low roof and absence of outside ventilation, there would have been a tendency for the air temperature to become excessive; to overcome this, propeller and extractor type fans were placed in the end walls. During the last hot season it was proved that with the aid of these fans the room temperature could be kept within reasonable limits.

Cabling

The cabling in the sub-station was carried out in trenches by means of paper-insulated lead-covered cables supported on cleats, while the feeders to the various switches in the mill from the 3,300-volt switchboard consisted of paper-insulated lead-covered single wire armored cables.

Owing to the congestion of the machinery in the mills, it was impracticable to run these latter cables in floor trenches. Economical runs could have been obtained by running the cables on the outside of the flat roof, but owing to the excessively high sun temperatures, which may reach 160 deg. F., this was also ruled out. The main cabling was, therefore, carried on a light fabricated frame work supported from the roof members. A straight run was taken from the sub-station the entire length of the two mills, the run being diverted at right angles at the center pass in each mill. At these points the cabling was run on hangers from the roof beams, a feed being dropped on to each platform. These runs are inconspicuous, but at the same time ample ventilation for the cable exists.

Changeover

It was decided that the actual changeover to electric drive should take place gradually and at week-ends. In this manner the entire conversion was effected without losing a minute of actual production working. The importance of this fact will be understood when it is remembered that at the time the Jute Mills Association were limiting the working hours to 40 per week, and had the process of changing over encroached on these hours, a very serious loss to the mills would have been sustained. In this connection it may be mentioned that when the associated millwrighting work was being done it was discovered that in certain areas a considerable ground subsidence had taken place since the mills were first built. This necessitated the entire re-alignment of certain line shafts, which work had to be carried out during the week-ends.

Owing to the type of drive, the complete absence of any ropes whatsoever, and the special care which has been taken over the alignment of shafting, the energy consumption per loom has reached what is believed to be a record low figure for any of the electrified mills on the river.

One of the advantages which may be mentioned of the policy of splitting up the electric drives into comparatively small groups is the facility which is given to the maintaining of the highest possible load factor. An example of the rates charged by the Supply Company is given below, and it will be immediately seen that it is most important to keep the average demand as closely as possible to the maximum demand.

Supply Company's Rates for Loads Between 3,500 and 4,500 kw.

Load Factor	*Rate per unit.*
30%	.383 anna
35%	.343 ,,
40%	.318 ,,

The value of the anna is approximately one penny.

Power Factor surcharge .0025 of an anna per unit for every 1% below 95%.

In an Indian jute mill and during the monsoon period rapid changes of humidity may occur, and during periods of heavy rains the moisture in the air may have immediate effect on the spinning frames and result in machines taking anything up to 15 per cent higher load than normal. If precautions were not taken this might cause a sudden increase in the maximum demand and a corresponding reduction in the load factor, which, in turn, would have the effect of increasing the cost of all the units consumed during the month. With the suitable grouping of various motors, however, this can be overcome, and it is frequently permissible, without affecting actual production to shut down various drives for a short period to prevent the maximum demand recording instruments from registering a total seriously in excess of the average demand.

The conversion of the installation was completed at the commencement of last year and the final switching-on ceremony was carried out by Mr. Wild, a partner in the Managing Agents' firm, on March 25, 1936.

The entire contract for the supply and erection of all the materials was entrusted to the English Electric Company, whose sub-contractors included Messrs. Douglas Fraser & Company for the supply of all shafting and millwrighting work, Messrs. Hans Renold for the chain drives and Messrs. Siemens Brothers for the cables.

NEW RAILWAY COACHES FOR CHINA

A demonstration was recently given at the Smethwick Works of the Birmingham Carriage and Wagon Co., in the presence of many mechanical engineers and railway experts, of the application of the "Vapor" heating system to coaches which are being built for the Canton-Hankow line of the Chinese Government Railways.

The "Vapor" system is in general use in the United States of America and Canada, and the equipment is now being manufactured in England by the firm of Gresham and Craven, Limited, of Manchester.

The chief features of the system are, that inside the cars of a train, steam for heating is supplied only at atmospheric pressure and that regulators are located outside the cars and are readily accessible. It is stated that, when once installed, no pipe joint need ever be broken for maintenance or examination of details, and that the system is economical in steam and sensitive in operation, and provides a maximum of controlled comfort for passengers.

High-pressure steam from the train line pipe is not used in the radiating pipes or in any of the valves or fittings inside the coach. The outlet of the equipment is always open to the atmosphere, and this makes it impossible for pressure or condensation to be built up. Pressure steam from the steam line is received by the regulator, converted to steam at atmospheric pressure, and distributed to cut-out valves which, when open, pass it on to heating coils or pipes in the carriages, or, when shut, short circuit it back to the regulator.

Return steam acting on an expansive diaphragm actuates the regulator and feeds steam to the system as and when required in exactly the necessary quantity. This diaphragm consists of a round flat-shaped box made of spring brass, which contains a small amount of expansive fluid and is hermetically sealed. The fluid boils at a temperature of about 180 degrees and when raised to about 212 degrees exerts considerable internal pressure. There are two types of the "Vapor" system, one hand operated and the other, which has been applied in America to passenger cars built in recent years, thermostatically controlled.

The Birmingham Carriage and Wagon Company are constructing 34 coaches for the Chinese National Railways. They are remarkable for their height, length, and roominess. Second-class vestibuled day cars have seats for 82 passengers, and a second-class sleeping car used for the demonstration to-day has 24 berths. The coaches are of all-steel construction.

Tokyo Laboratory

Has 3,600,000-volt Impulse Voltage Generator

By H. ROKKAKU and Y. SHINGU, in The Electrotechnical Journal

(Hidemichi Rokkaku, Viscount, is research engineer of the Third Section of Electrotechnical Laboratory, Ministry of Communications. Yukihiro Shingu is assistant engineer of the same laboratory.)

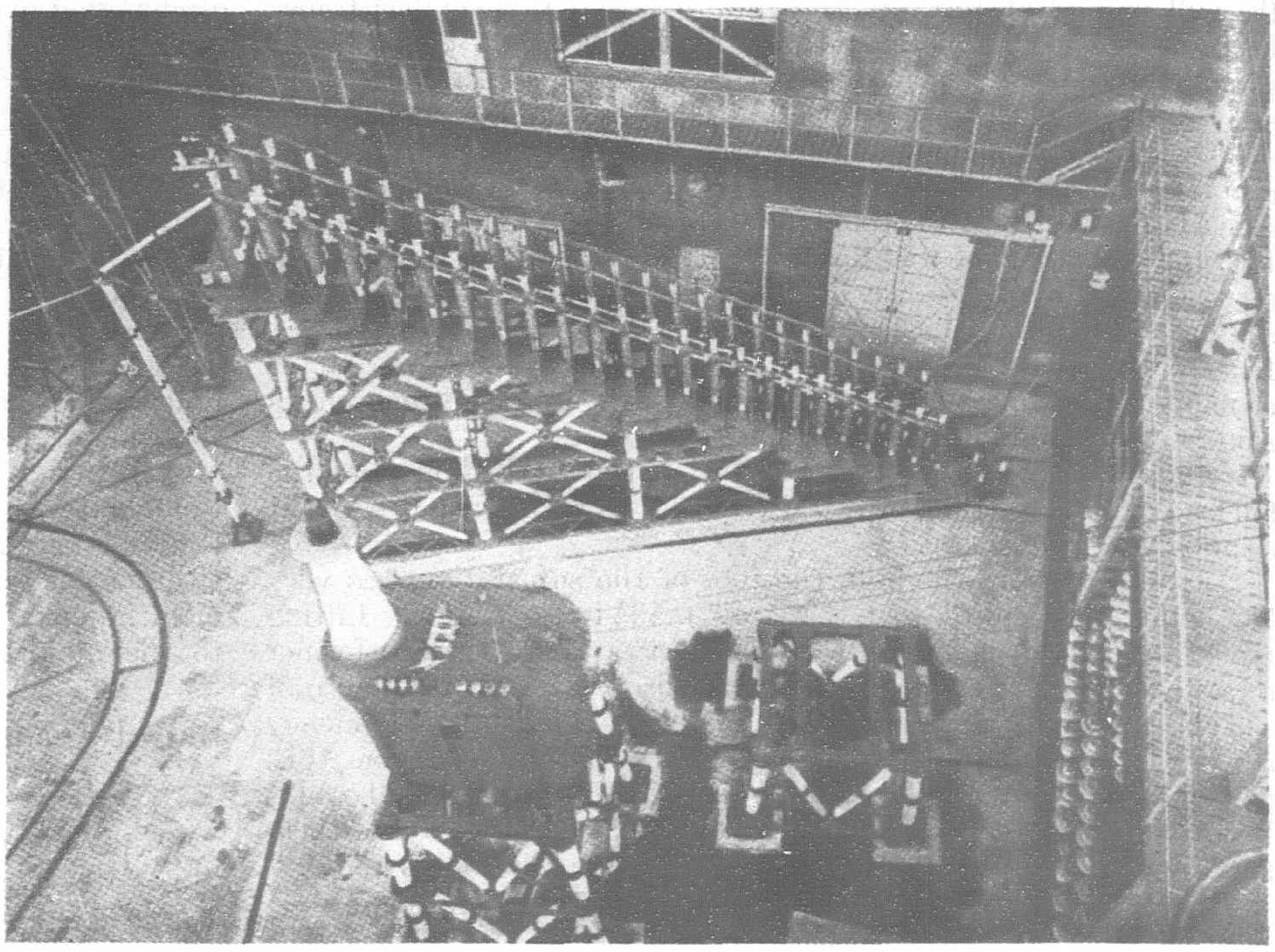

Fig. 1.—General interior view of the newly installed 3,600,000-volt impulse voltage generating equipment of electrotechnical laboratory, Ministry of Communications, Japan

At the end of 1936 the Electrotechnical Laboratory, Ministry of Communications, completed the installation of a 3,600,000-volt impulse voltage generating equipment in the High-tension Laboratory at its Nagata-cho Branch, Tokyo, for the purpose of investigating the characteristics of lightning and methods of preventing damages from it. On December 3, of the same year, this equipment was tested by engineers of the Laboratory and the results obtained were very near to their expectation.

Figure 1 shows the general view of the equipment. Forty-eight condensers that are connected as shown in Figure 2 and forming the main part of the equipment are charged in parallel with the direct-current voltage of approximately 75 kv, and discharged in series, thereby generating an impulse voltage of roughly 3,600,000-volts. The structure of the insulating stand, as shown in Figure 1, rises gradually upward in oblique direction from one corner of the High-tension Laboratory, occupying a space having the form of the right triangular prism whose base is 12×3 m² and height is about 7.3 m, where the height of the condenser is taken into account.

The High-tension Laboratory measures 24×18 m² in area, and 18 m in height. It is planned to install in this laboratory by the side of this equipment a commercial-frequency testing equipment for 750 kv, consisting of three 250 kv testing transformers chain connected, a part of which is seen in Figure 1.

Since this high-tension laboratory is constructed for rain test, all the apparatuses installed here are of the outdoor type.

Condenser and Output of the Equipment

As to the capacity of the 48 condensers used in this equipment, the maximum was 0.265 μF, the minimum, 0.256 μF, and the average, 0.259 μF. They have passed the pressure test of the direct-current voltage of 75 kv for 10 minutes and the breakdown test under the direct-current voltage of above 110 kv.

When 48 of these condensers are connected in series, the capacity of this equipment is approximately

$$C = \frac{0.259\ \mu\text{F}}{48} = 0.0054\ \mu\text{F} = 5.4 \times 10^{9}\ \text{F} \qquad (1)$$

If each condenser is charged to 75 kv, the crest value of the maximum voltage that can be generated by this equipment reaches

$$E = 75\ \text{kv} \times 48 = 3{,}600\ \text{kv} = 3.6 \times 10^{6}\ \text{V} \qquad (2)$$

Consequently the energy expended by a single discharge is

$$\tfrac{1}{2}CE^2 = 35\ \text{kw s} = 35 \times 10^{3}\ \text{J} \qquad (3)$$

In practice, however, since not a little power is consumed by the internal impedance of the equipment itself, the rating of this equipment will be approximately as follows:

The crest value of the maximum voltage	3,000 kv
The power consumed by a single discharge ..	25 kw s

Furthermore, if a strong current is needed rather than a high voltage, proper condensers can easily be connected in parallel so that the static capacity of the equipment as a whole becomes four times, 16 times, 36 times, 64 times, 144 times, 576 times, or 2,204 times the value of Equation (1).

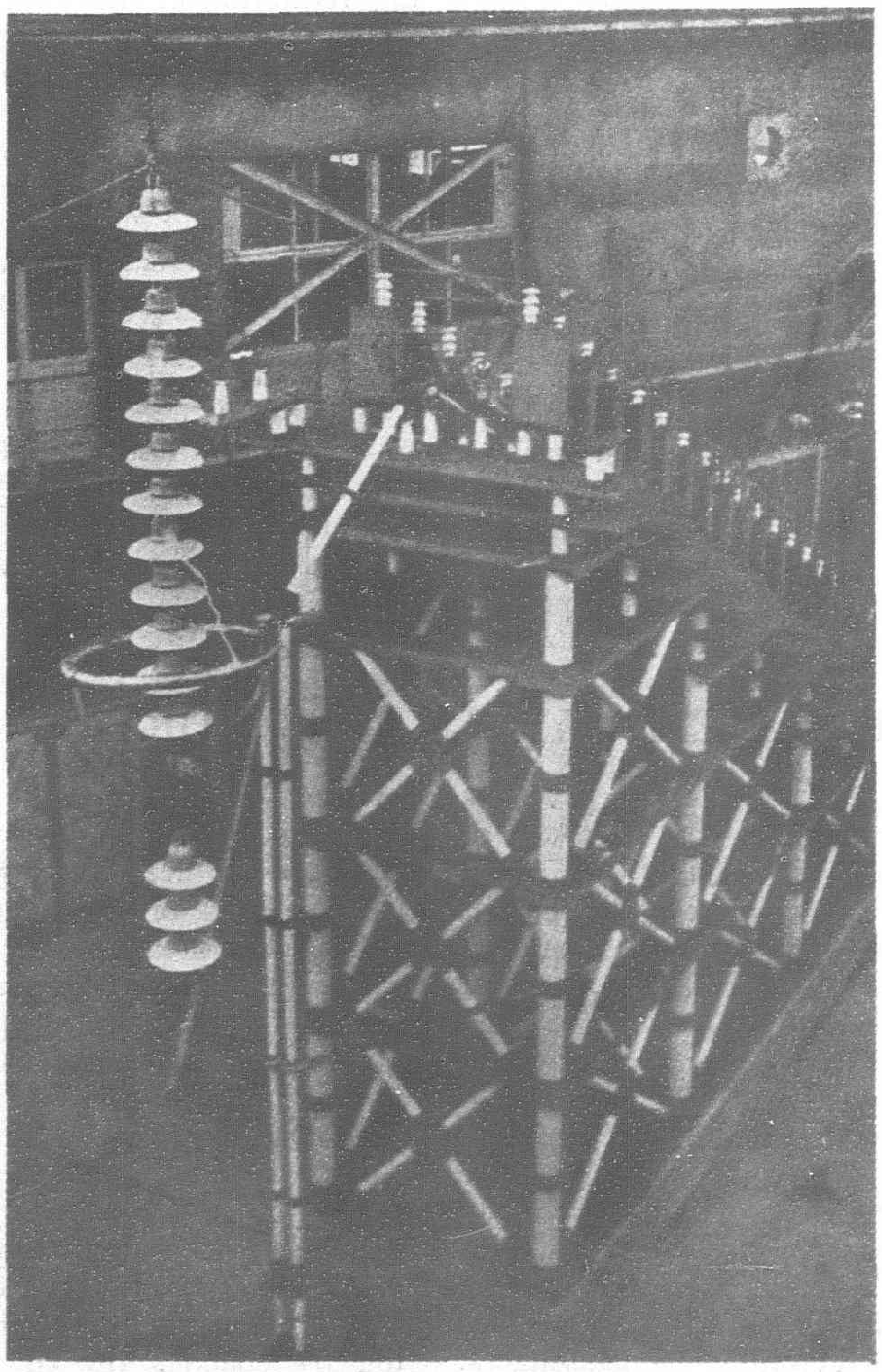

Fig. 3.—An example of flashover taking place over a suspension insulator string at a voltage of about 2,500 kv generated with this impulse voltage generator

Charging Circuit

The following points have been specially taken into consideration in determining the charging system of the equipment:

(1) The generated voltage must be easily regulated and the polarity easily controlled.

(2) The starting of the equipment and the joint operation with other equipments such as an impulse current generator, a cathode-ray oscillograph, etc. must be easily controlled.

(3) The charging circuit must be simple, easily constructed and installed.

(4) The charging rate of all the condensers must be equal.

As a source, the direct current rectified from the 50-cycle alternating current was used by reason of (1) and (2). As to the connection of the charging resistance, the so-called Marx circuit must be employed by reason of (3). but an original improvement has been made so that the condition of (4) is satisfied as well.

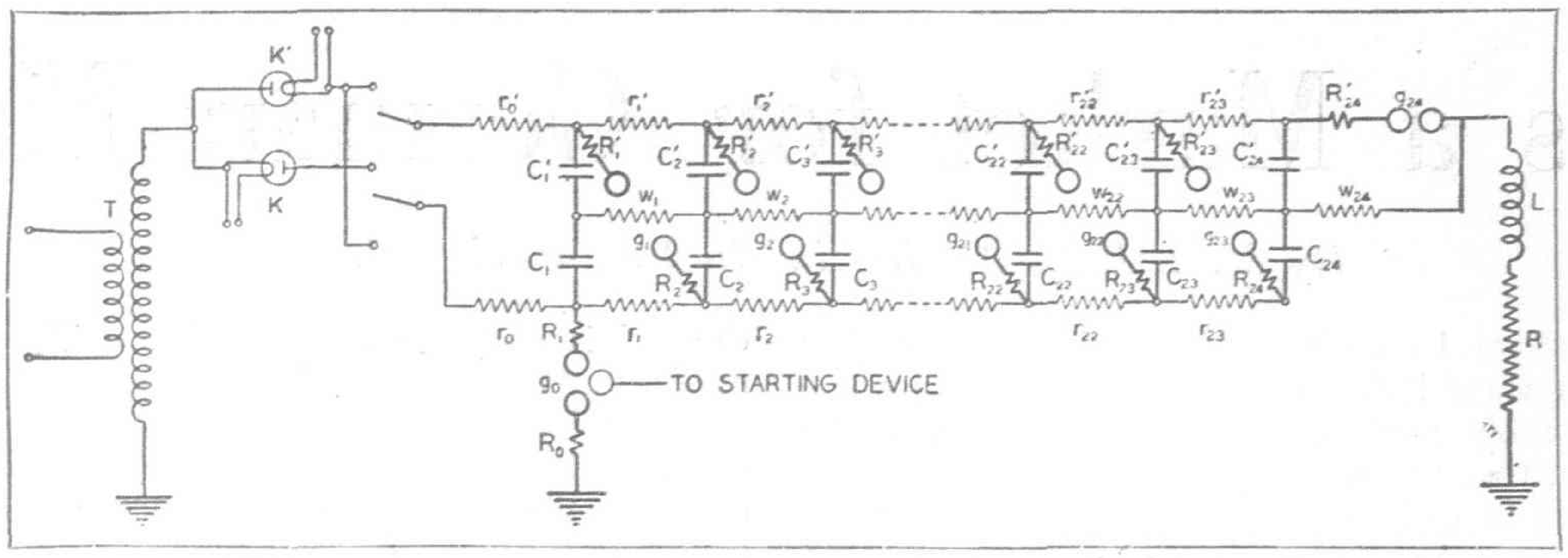

Fig. 2.—Schematic diagram showing the connection of the 48 condensers

These conditions can be satisfied simply, if the charging resistance be connected as shown by the light lines in Figure 2 being supplied from one end of w_{24} corresponding to the high potential end of this equipment, and from one end of r_0 and r_0' corresponding to the earth end, and the values of r_1, r_2, ... r_{23}, r_1', r_2', ... r_{23}', w_1, w_2, ... w_{23}, were taken so as to satisfy the following equations :

$$r_n = r_n' \tag{4}$$

$$w_n = r_n \left(\frac{24}{n} - 1\right) \tag{5}$$

where n is a positive integer smaller than 24.

Discharge Circuit

As shown by the heavy lines in Figure 2, the discharge circuit consists of the connecting leads of each condenser and discharge resistance, the inductance coil, and the cascading gaps. The internal inductance of this discharge circuit is made as small as possible except the inductance coil, and so is made the effect of the stray capacity of each part of it.

A part of the discharge resistance is distributed between each condenser and the cascading gap, and the remaining greater part has been inserted in series with the inductance coil, between the high potential end of the equipment and the ground.

The former has been inserted so as to suppress the local oscillation in each part of the discharge circuit. The element of this resistance consists of stranded silk-covered nichrome wires wound on the bakelite plate after the manner of Ayrton-Perry (a type of bifilar winding) so as to make the shunt capacity and the self-inductance as small as possible. The resistance of each element being about 5Ω, since they are inserted on either side of each cascading gap, the total resistance is approximately as follows:

$$R_d = 5\Omega \times 48 = 240\Omega \tag{6}$$

The latter, the concentrated discharge resistance, consists of the circulating electrolyte in porcelain tubes, the resistance being adjusted by the concentration of the electrolyte. Brine is used as an electrolyte, being circulated by an acid-proof pump. As a few taps are provided near its each end, the discharge resistance itself may be used as a resistance potentiometer.

As to the inductance coils, those rated about at 3 mH are under construction.

The cascading gaps consist of 25 pairs of 100 mm diameter sphere gaps, and the lowest one is provided with a third electrode used as a starting gap, which is rather a new scheme. The porcelain rods adjusting these gaps are placed in parallel along the inclined plane of the insulating stand, and they are free to slide in their axial direction. There is a device, under the lowest ends of these rods, which changes the rotation of the gear operated by a three-phase induction motor to the linear reciprocating motion, its linear motion being directly transmitted to the rods. All the gaps can be adjusted simultaneously from zero to 100 mm at the average rate of 1 mm per second.

Control Switchboard

This equipment can be entirely operated from the control switchboard installed on the second story at a place commanding a clear view. Since there is a plan to install the control switchboard for the testing transformer of commercial frequency, it serves very conveniently for the test when the impulse voltage is superimposed upon the commercial-frequency voltage.

New Oil Burning Air Conditioning Equipment Has Winter and Summer Uses

Differing radically from any existing heating or air conditioning equipment, a new oil-fired warm air conditioner developed by the General Electric Company of New York was recently shown for the first time at the Oil Burner and Air Conditioning Exposition in Philadelphia. Small in size, the new equipment will supply automatic oil heat and winter air conditioning in a single compact unit. It will clean all incoming air, remove dust and add moisture and heat. Its fundamental principle is a method of burning oil, the forcing downward of atomized oil to meet an upward secondary air stream, producing a floating white-heat flame five feet long that turns upward on itself. Combustion is so complete with this method that furnace and chimney flues are seldom in need of cleaning, and considerable economy in the consumption of low-grade fuel oils is possible.

A series of electric controls supervise and protect the equipment. The humidistat automatically controls the supply of moisture to living quarters during the heating season. Air filtering and circulation in summer are available through the installation of a summer switch. A thermal control, or snap action thermostat, maintains the desired temperature. Quiet operation has been assured through the use of the newly-developed aphonic radial flow fan. For a given air flow and a given pressure drop, this fan produces less noise and uses less power than any other fan of similar type and size.

Large area viscous coated glass wool filters of large dust-holding capacity remove dust and dirt from the air, while the placement of radiation screens is such as to maintain a cool outside jacket, providing longer life and greater efficiency. An expansion relief door shuts down the entire equipment in case of surges or irregularities.

The compressor motor is self lubricated with fuel oil, the burner nozzle is air-cooled, and ignition is by an electric spark. The burner head operates at a low temperature, and the welded copper bearing steel air-tight heating unit eliminates any possibility of flue gas leaks, assuring safe operation.

Despite its small size, the new unit, designated as type L.B. 3, will do a complete job of heating and air conditioning a home, with the exception of cooling, and it has been designed so that this can easily be added if desired.—*Eastern Engineering and Commerce.*

NEW SUBWAY.—Construction of the Shibuya-Shimbashi subway line of the Tokyo Rapid Transit Company is now under way and is expected to be ready for traffic in the near future.

The section between Miyamasuzaka and Shibuya station will be an elevated line with the terminal station connecting with the third floor of the department store operated by the Tokyo-Yokohama Electric Railway Company.

Another subway, connecting Shinjuku and Yotsuya-mitsuke, is included in plans for the first construction period, but details of this have not yet been arranged. In the second period of construction, the company proposes to extend the Shinjuku-Yotsuya-mitsuke line to Tsukiji in Kyobashi ward. Other projected lines will connect Tokyo station with Meguro, Ikebukuro and Minami Senju.

The Tokyo Subway Company, which operates the present line between Asakusa and Shimbashi, has already started construction on an extension to Gotanda station.

China as a Market for German Machinery

By M. DOERING, Berlin, in Engineering Progress

CHINA is an agricultural country. Eighty per cent of her population gain their living by farming, mainly by the simplest conceivable methods. Nevertheless it may be said that China, too, has been drawn into the process of industrialization which set in with the advent of the steam-engine in all countries. This is true, not alone of the hitherto industrial centers which are principally situated along the coast within the range of the foreign concessions, but industrialization, which is equivalent to the spread of efficiency, is slowly advancing also into the interior of the giant realm.

The vast extent of the country, of which large districts are either not at all or but very imperfectly open to traffic, explains why modern production methods have thus far been introduced only along the seaboard. Agriculture, trade, and industry are, however, beginning to show an interest in Western engineering also where the interior is accessible by waterways and by the railway. This development is being actively advanced by the Ministry of Industry which was formed in 1930. Dr Kung, the present Minister of Finance and Vice-Prime Minister, who was also the first Minister of Industry, recently pointed out that the Chinese Government is not alone seeking the participation of foreign countries in Chinese railroad construction, but is equally interested in opening up the mineral deposits of China and in upbuilding Chinese industry.

While there are some 450 million people in China, her machine consumption per head is the lowest of all countries in the world. In view of this fact, the conclusion might be jumped at that China might be a land of unlimited possibilities in regard to industrialization and machine exports. This can be said to be true only, however, if considered as applying to the extended future.

How slowly mechanization is progressing in China is best illustrated by the development of machine imports represented in Table 1. In this table, the imports during 1933 have been assumed as unity, 1933 being the year when machine importation into China declined to its lowest level in consequence of the world crisis.

TABLE 1.—CHINA'S TOTAL MACHINERY IMPORTS

Year	*RM.*	*Per cent of imports in 1933*
1926	64,074,000	193
1930	99,044,000	295
1932	40,768,000	122
1933	33,392,000	100
1934	44,768,000	134
1935	49,270,000	152
1936	43,937,000	131

TABLE 2.—PRINCIPAL GROUPS OF GERMAN MACHINE EXPORTS TO CHINA DURING 1936

Machine Groups	*RM.*	*Share of total machinery imports per cent*
Machine tools	2,362,000	19.1
Prime movers	2,213,000	17.9
Steam locomotives	1,864,000	15.0
Textile and clothing machinery ..	1,114,000	9.0
Paper-making and printing machinery .	924,000	7.5
Food-stuffs machinery	885,000	7.1
(in above, flour-milling equipment) ..	(339,000)	(2.8)
Pumps and air compressors	598,000	4.8
Conveying means	243,000	2.0
Agricultural implements	240,000	1.9
Office machines	185,000	1.5
Miscellaneous	1,759,000	14.2
Total	12,387,000	100.0

The introduction of the new monetary system in November, 1935, which rapidly established itself in all parts of the country, was undoubtedly a great success of the present regime. Particularly in the last years, the political and economic consolidation of China has progressed so far that a higher capacity for absorbing machinery may be confidently expected for the near future.

For the present and for some time to come, most of the machines exported to China will go into the existing and expanding industrial centers near the coast or along the great waterways. Under this head unquestionably comes the principal portion of German machine exportation. This is particularly true of machine tools, prime movers, and machines for the textile and clothing industries, which, as will be seen from Table 2, amounted to 46 per cent of the total German importation in 1936.

From among existing Chinese purchasers, the cotton industry merits special attention as being by far the most important Chinese industry in point and extent and increase in occupation. This industry mostly works up Chinese home raw materials and produces goods both for inland consumption and for export. While, in most countries, the cotton industry was exposed to critical disturbances after 1929, China showed an increase in looms of from 29,000 in 1930 to 52,000 in 1935, or in other words, of 80 per cent. During the same period, yarn and thread spindles increased by 22 per cent, to a total of 5.5 millions. Good chances for selling machinery are afforded by plants devoted to the perfecting of cotton goods by dyeing and printing. These plants are predominantly Chinese, and 60 per cent are domiciled in Shanghai.

As against this, the well-known Chinese silk industry, of which Shanghai is likewise the center, has been severely suffering under the general depression and especially from the competition from Japanese artificial silk. By way of an example, production in Shanghai had in 1934 declined to 30 per cent of what it had been in 1930. There can be no present thought here of an expansion of plants, inasmuch as a very considerable increase in demand can be taken care of by existing capacity.

Another important Chinese industry is grain milling. The large flour mills are mostly located in the coast cities. Their production could be appreciably raised if the grain harvest in the interior of China could be more rapidly and cheaply transported. The Chinese Government has accorded this question its particular attention, with the result that in spite of depression and financial crisis, the grain milling industry has considerably expanded within the last years. The extent to which China avails herself of German machinery in equipping its flour mills is demonstrated by the fact that, within the last year, 81 per cent of the total importation of such machines came from Germany.

An industry which is confined to a few towns, viz. Shanghai, Tientsin, Hankow and Tsingtau, is cigarette manufacture. Here the machine frequently has to compete with hand labor, which is extremely cheap in China. 60 per cent of the Chinese cigarette output is made by hand.

Quite a number of branches of industry have of late years been called into life in Chinese industrial centers in connection with the direct demands of these centers themselves. An instance is the cement industry, the expectations of which may be considered as very favorable in view of the growing demand for city house and municipal building, and for factory, bridge, and road construction. The same is true of the manufacture of bricks and roofing tile, the production of which by modern methods was taken up in 1908, at first at Shanghai, while until then these goods had been almost wholly produced by hand.

In Table 2, machine tools occupy first rank and form the largest item in the total German machine export to China. Although the metal-working industries proper are as yet confined to mere beginnings, there is nevertheless every prerequisite for their growth, inasmuch as rich ore deposits are available in the Yangtze valley and in Eastern China. Pig-iron production, however, is still very slight thus far.

The German machine exports to China so far discussed are principally sold in the few districts which have already been industrialized. The enormous remainder of the country will become capable of absorbing such machines only when China has been further opened to traffic. The construction of railroads here led the way, just as it did in North and South America. The building of railroad lines, and what is particularly interesting in this connection, the necessary machine and rolling stock equipment, therefore lead the production means imports. In 1936, for instance, steam locomotives totalled 15 per cent of the German machine exports to China and therewith formed the third largest item. The development of orders entered this year allows of the conclusion that in the future, locomotive supplies may even advance to first place in German machine imports. At present, a large project is under way for building of a number of lines to connect Szechuen, Kweichow and Hunan with the existing system. Besides offering chances for the sale of locomotives, the construction of each and every railway line affords sales possibilities for the equipment of railway repair plants, signalling means, and the like.

TABLE 3. SHARE OF DIFFERENT COUNTRIES IN CHINESE MACHINERY IMPORTS

(in per cent of total imports)

Year	*Germany*	*Japan*	*U.S.A.*	*Great Britain*
1932	14.3	16.4	16.1	40.2
1933	15.8	15.4	16.1	42.6
1934	14.5	16.2	15.4	34.4
1935	25.4	21.0	15.0	19.9
1936	18.0	25.5	9.3	21.7

The third possibility of machine sales is one which has at present at least materialized but offers the greatest chances for the future. This is the industrialization of inner China. As has already been mentioned, industrialization means the introduction of machine methods into Chinese agriculture and into manufacture in the interior. Although China is an agrarian country, the share of her purchase of agricultural implements in the total machine-equipment imports amounted to but 1.9 per cent of German imports. This fact proves the extent to which the introduction of machines into inner China is a traffic problem. Except where agricultural districts are accessible by waterways, it has only been with the advent of the railroads that it became at all feasible to market the grain harvest. With an improvement in traffic conditions, an extension of the growing and sale of food-stuffs beyond the needs of the food-producing districts would be possible. It would likewise become practicable to raise the output of industrial agricultural products, such as cotton and soya beans, and so to create a foundation for manufacturing industries. Relatively well connected provinces like Kirin, Liaoning and Hopei, for instance, grind their flour in partially industrial mill plants.

Also in the widely distributed anthracite and lignite districts, mining is governed, not by the magnitude and accessibility of the deposits but by existing traffic connections. The coastal areas show the greatest production, whereas the provinces with the largest deposits, Shansi and Shensi, occupy the third and nineteenth place in point of output because they have no connection with the communication lines. Exactly the same holds true of ore mining as well as of many other industrial possiblities.

It is here, then, that we come up with the limits of China's industrialization and therewith of her capacity for absorbing machinery. A further such limit is constituted by the fact that, generally speaking, the only industries operated on a large scale are those which it is not possible to work otherwise, as for instance cotton mills, iron and steel works, shipyards, grain milling and cement plants. Wherever small-scale methods are also feasible, they usually persist, as in the case of silk spinning, cloth and hosiery production, match manufacture, printing plants, cigarette factories, and the like.

One of the characteristics of industrialization in China, indeed, is the much higher importance of manual work by comparison with machine work. Over three-quarters of the manufacturing output of China is derived from farm houses and rural shops. This condition will probably change but slowly with increasing industrialization. Chinese economic experts are therefore considering the plan of furthering and modernizing these rural shops by means of manufacturing associations.

It is very well possible that the small machines which have been developed in Germany for the use of artisans and small industrial enterprises, will some day find a very favorable market in China. Under this head come, above all, irrigation machinery, especially pumps, but also small lighting sets, single machine tools, easily operated internal-combustion motors of up to a few horsepower, as well as small printing presses, foodstuff machine equipment, and the like. Already to-day, a certain volume of these machines is being shipped to China. There is no question, however, that this branch of German machine exportation may be expanded very greatly in course of time.

All in all, it may be said that German machines have easily held their own in the Chinese market. As will be seen from Table 3, German machinery forms a larger share of the total machine imports in 1935 and 1936, than it did in the preceding years.

The most important competitor of the German machinery industry is Japan, while Great Britain's share has greatly declined, principally in favor of Japanese and German imports. Japan, which is one of the more recent machine-building countries, principally furnishes the simpler types of machine, while German industry is able to supply suitable production means also for more difficult requirements. In this maintenance of German imports, a principal factor has been the reputation for quality and capacity which German manufacturers have secured for their products in decades of co-operation with Chinese economic interest.

New Rubber Substitute Has Many Uses in Engineering Industries

Articles made from Neoprene or Neoprene compositions for use in engineering, automobile and aircraft construction, electrical appliances, and the printing, textile, petroleum and chemical industries, were shown recently at an exhibition organized by Imperial Chemical Industries, Ltd., at the Federation of British Industries, Westminster.

As already stated in this journal, Neoprene is a new raw material with rubber-like properties. For purposes for which natural rubber is unsuitable, it can be used, but it is not a substitute for natural rubber.

The key to the production of Neoprene was discovered fairly recently. Products of the old synthetic processes, based on Isoprene, had the disadvantage that they were difficult to mill because their molecules were in the form of branched chains. By introducing chlorine the molecules were made to form long, straight chains, as in natural rubber, and Neoprene is the first " synthetic rubber " with this particular construction. Therein lies the ease with which it can be milled, extruded, or calendered.

Possessing all the elasticity and tensile strength of the best natural rubber, to which it is incomparably superior in its resistance to oils and certain solvents, Neoprene has a higher resistance to ozone and ultra-violet radiation, is less affected by chemicals and less permeable to gases, and does not soften, but tends rather to harden, under the influence of heat. Also its water absorption is low.

From the mechanical engineer's point of view, the major drawback to natural rubber is that it perishes in contact with lubricating oil. Neoprene will find application in the manufacture of gaskets, washers and packing, and its resistance to oil and water mixtures should attract the attention of engineers concerned with air compressors, hydraulic machinery, and pumps in general. Another obvious use is for transmission and conveyor belting working under oily conditions. In the electrical industry Neoprene's resistance to ozone, the well-known " corona effect," heat and flame makes it a first-rate material for high tension and lead-in cables, and even for the light flex of domestic appliances.

Neoprene's resistance to heat, flexing and ageing stamp it as an ideal material for engine supports and shock absorbers, for fuel hoses and pipes and ignition cables, and its low absorption of water for pump washers. In the aircraft industry the same uses generally apply, but, in addition, Neoprene has found application as strip washer for aeroplane-wing petrol tanks, roller rings for collapsible struts, sparking plug cap protectors, and cork/Neoprene oil gaskets. —*Eastern Engineering and Commerce.*

Technical Developments in Japan

A NEW type centrifugal dehydrator specially designed for alkali-reclaimed rubber was recently delivered to the Kurume factory of the Bridgestone Tyre Company in Kyushu. The machine is of original Japanese design, being made by the Tokyo Dassuiki Seisakusho (Tokyo Dehydrator Works). The rubber is fed into the machine automatically by means of a screw conveyor. It is claimed that more than 60 per cent of the moisture can be separated. The machine has a capacity of from 10 to 15 tons a day.

The Japanese Communications Minister has applied for a patent covering a new method to pulverize rubber. The main feature of the process is the novel composition of the pre-mixture, which is prepared by blending polyvalent aminos, tri-ethyl-trimethylene, triamine and stearin acid. Either a mixture of these components or aethanol soap, or a mixture of both, is mixed into the rubber, which may then be ground by a suitable mechanical method.

Mr. Keiichi Shimada, former professor of the Kiryu Higher Engineering School, and now president of the Nippon Rubber Science Institute, has announced a new method for working reclaimed rubber. Vulcanized rubber is first mixed with aromatic nitro compounds, and either of the three—nitro-compound, di-allyl-thio-urea, or mercapt-benzo-thiazol—and then heated under high temperature in an airtight chamber. It is then thoroughly kneeded.

A certain grade of Japanese silk, internationally known as "habutae," is being marketed in rubberized form to meet various requirements. Silk does not accept rubber by the usual methods. It is first coated with rubber paste, in the second phase of the Japanese process a latex layer is applied (latex+sodium silicate +ammonium oleate), and finally, a finish of nitrocellulose, which is mixed with castor oil, benzol, and some plastic substance, is sprayed over. Two typical applications of this process are raincoats and moth-proof bags. The latter are marketed with a zip-fastener and a cloth hanger, the latter placed inside the bag.

A new process for imparting a fibrous surface to rubber hosiery, etc., as employed in Japan for some time, may be briefly described as sandwiching a layer of rubber between two sheets of napped fabric under pressure from both sides at a temperature of 50° C. Then the cloth is stripped off the rubber, leaving some fibre on the latter's surface. The coating is napped, and may be printed upon or otherwise finished.

The rubber department of the RIKEN (short for RIkagaku KENkyusho, or Institute for Physical and Chemical Research), now capitalized at Y.8,000,000, is reclaiming rubber by a new tetralin method. An outstanding feature of this process is that the product has a very low rate of abrasion. It is further extremely resistant to oil and alkali, and its physical properties vary but slightly under extreme temperature conditions. With an addition of only 20 per cent of virgin rubber, it is moulded into tyres. The process has been developed by the institute with the aid of a Government subsidy. It is claimed to be far superior in many points to the conventional oil and alkali reclaiming methods.

The description, in the Japanese language, published in the bulletin of the institute, lacks somewhat in preciseness. It seems that at first the waste is reduced to small particles, which are ground to powder. The latter is washed in alkali and thoroughly mixed with tetralin. The mixture is heated under high pressure, and the sulphur precipitated. The tetralin is recovered by a special process (details of which the paper fails to communicate), and the rubber solidified into sheet. Dr. Viscount Masatoshi Ohkochi, President of the RIKEN, is expected to head this reclaimed rubber enterprise.

A new organic accelerator for rubber is obtained by mixing diphenyl-urea with zinc salts of organic acids in the presence of ammonium. The organic acid diphenyl guanidine thus obtained is reduced to diphenyl-guanidine by treating it in alkali solution. Diphenyl-guanidine is recommended as an effective accelerator.

The method by which "udon" (Japanese vermicelli) is manufactured has been successfully applied in the production of rubber thread. Unvulcanized rubber is first rolled out into sheet, which is treated in a solution of magnesium carbonate. After leaving the bath the sheet passes through the vulcanizer, and is conveyed to a cutting mechanism consisting of circular revolving blades.

Rubber has opened up a new market in Japan's thriving bicycle industry. Its use as raw material is now no longer restricted to the manufacture of tyres and inner tubes, but saddles are being made of rubber as well. Although leather is not entirely dispensed with, the new process makes possible the utilization of cheap grades of leather, which otherwise are unsuitable for this purpose. Unvulcanized sulphurated rubber plate is pasted on leather by means of rubber paste. Pieces of desired shape are stamped out and moulded into saddle form, after the leather has been softened through immersion in water. The saddles are then open-cured. These saddles are said to have excellent shock-absorbing qualities. By means of the strong rubber lining the irksome pressure at the spring supports common with leather saddles is distributed over the whole sitting surface, it is claimed. The new rubber saddles supersede the rubber covers for leather saddles some firms had been marketing. The latter had proved impracticable because of excessive generation of heat.

Elastic rubber members have been used for some time past in automotive practice to mount engines, transmission members, etc. In these cases the rubber has taken on the rôle of a cushion or shock-absorber, or, in other words, the rubber is subjected to *compression*. The General Motors Corporation of Japan has applied for patent rights on a new type of rubber mounting, in which the *tensional* characteristics of rubber are utilized in accordance with the principles discovered by H. D. Geyer, of Dayton, Ohio, assignor to General Motors. The main feature of this process is the vulcanizing of the rubber members to vertical steel surfaces by abnormally increasing the contact surface of the member to prevent its tearing loose from its bond with the metal surface. The greatest advantage of this method is seen when applied to flexible mountings in the transmission line, because driving members whose flexibility depends solely on the compressibility of a rubber block, are naturally limited in their actional freedom, but it is also considered desirable to suspend the engine rather than to put it on rubber members, because a greater shock-absorbing efficiency is seen when the former exerts shear or tension instead of pressure on the latter.—*The India Rubber Journal.*

£4,000,000 PORT PLAN

China is planning to build a new harbor, costing £4,000,000, on the north side of Hangchow Bay, just south of the port of Shanghai, which it will rival.

This announcement is contained in a report submitted by the Chinese Government to the League of Nations Organization for Communications and Transit.

The report says that preliminary work on the scheme is already well advanced.

The port will take 15 years to complete. It is called the Great Eastern Harbor, after a port which flourished on the same spot centuries ago under the Sung and Yuan dynasties.

The Great Eastern Harbor, it is claimed, will have two big advantages over Shanghai.

It will be nearer to America, Europe and Japan than Shanghai, and while it is situated on a bay, and protected from the sea, it will be easy to enter at all states of the tide.

This is a contrast to Shanghai, where large ships have to wait for a favorable tide, and where much money has to be spent on dredging the Whangpu River.

While the Great Eastern Harbor is under construction, a scheme of railway communications linking it with the chief commercial centers of Eastern China will be studied.

Work on it will begin when plans have been prepared.

Engineering Notes

INDUSTRIAL

NEW COTTON MILL.—The Nagasaki Cotton Spinning Co., will establish the Nagasaki Cotton Spinning Co. No. 2 with an authorized capital of Y.10,000,000.

BEER BOTTLE FACTORY.—Work on the new Mukden beer bottle factory of the Tokunaga Glass Co., Osaka, is nearing completion, and production is scheduled for next October. The initial output will be 60,000 units daily.

NEW BREWERY.—In co-operation with the Mitsui Bussan Kaisha, Ltd., the Dai Nippon Brewery Co., Ltd., plans the erection of a brewery at Manila. An annual output of 100,000 boxes of 48 bottles is aimed at, a capacity equivalent to roughly half the whole yearly demand for beer in the Philippines.

SULPHATE OF AMMONIA.—The Taiwan Chemical Industry Co., which has been established as one of the subsidiaries of the Nippon Industrial Co., will commence the production of sulphate of ammonia by utilizing natural gas. The authorized capital of the company is Y.10,000,000, which is now paid up to the extent of one-fourth.

SULPHATE OF AMMONIA.—In order to stabilize the demand for, and supply of, sulphate of ammonia, the Fertilizer Duties Committee has recommended the control of imports and exports by means of a licence system. If present plans are realized the Committee's proposal will probably be enforced very soon and remain effective until the close of 1938.

A NEW PLANT.—To raise funds for the construction of a plant for the manufacture of sulphate of ammonia on the reclaimed land in Yokohama, the Dai Nippon Tokyo Fertilizer Co. has decided to increase its capital by Y.7,500,000 to Y.10,000,000. When completed, the new plant will be capable of producing 60,000 tons a year by the German G.E. process.

COAL LIQUEFACTION.—The South Manchuria Railway Co. has decided to build a coal liquefaction plant at Fushun, where a number of mines produce about 8,200,000 tons per annum of some of the finest steaming coal in the Far East. An expenditure of 14,000,000 yen is contemplated, and it is hoped to complete essential construction work by June, 1938.

NEW COTTON MILL.—A cotton mill to be capitalized at $7,000,000 is to be erected in Chekiang. Shanghai Chinese bankers and the Chekiang Provincial Government will invest a total of $3,000,000, while the Ministry of War, $1,000,000. The remaining sum is to be raised in a period of fifteen years for the payment of machinery to be purchased from British concerns.

POTASSIUM BROMIDE FACTORY.—The Fuji Photographic Film Co., Ltd., is to establish at Odawara a factory for the production of potassium bromide, silver nitrate and other chemicals. This was announced recently by the president, Mr. Shuichi Asano, who stated further that the capacity of the dry plate and printing paper sections of the Ashigaru works would be doubled.

AMMONIUM FACTORY.—Ammonium production is contemplated by the Kyushu Soda Co., and a factory with a capacity of 100,000 tons per annum may be built at Konahama. The Toyo Soda Co. is undertaking extensions which will bring the total yearly capacity of their plant up to 65,000 tons of ash and 72,000 tons of caustic soda. Later, the Toyo concern will increase its capital from Y.3,000,000 to Y.10,000,000, to enable further expansion.

MANCHURIA SODA INDUSTRY.—Understanding has been reached between manufacturers in Japan and those interested in the soda industry in Manchoukuo relative to the founding of the Manchuria Soda Company. This company, together with the Manchuria Salt Industry Company, which started business some time ago are expected to play an important rôle. The new concern, capitalized at Y.8,000,000, would build a factory at Kanseishi, near Dairen. Raw material would be bought from the Manchuria Salt Industry Company.

NEW THEATER.—A four-storied building with two-storied basement, housing a variety show theater and a basement movie hall, will soon be built in the Sennichimae, Osaka's amusement quarters, by the Yoshimoto Co., if plans submitted to the Osaka prefectural architectural section are approved.

According to the plan, the hall will be built on a 356-*tsubo* plot of land adjacent to the Nanyokan variety show theater. The basement movie hall will have accommodations for 563 persons in addition to standing space for 95.

The first, second and third floors will be used as a variety show theater with 1,251 seats and standing room for 80.

NEW RAYON FACTORY.—The Nippon Rayon Co. is planning to establish a factory each in Fusan and Masan, Chosen. The production capacity of each factory will be 35 tons per day. Not only the Nippon Rayon, but also other rayon companies are expected to show their activity in Chosen in the near future.

VEGETABLE OIL BUS.—The usefulness of vegetable oil as fuel for motor-cars has been demonstrated by the vegetable-oil bus of the China Motor-Car Manufacturing Company. The car joined the Nanking-Yunnan motor caravan and reached Kunming on April 29, having covered a distance of 4,109 kilometers and consumed 410 gallons of vegetable oil. It is estimated that the use of vegetable oil is 86 per cent cheaper than gasoline. The success of the vegetable-oil bus is considered significant by communication circles as it proves that a substitute for the more expensive imported fuel, gasoline, has been found.

COMMUNICATIONS

NEW BRIDGE.—The steel bridge spanning the Wei River in Shensi at Shanyang, erected by the Lunghai Railway, has just been completed, and was opened to traffic on June 1. The bridge is nearly 2,500 feet long.

NEW TRAMWAY.—The Shanghai City Government has decided to inaugurate a rail-less tram service in areas under its jurisdiction. A sum of $1,800,000 will be set aside for the purpose.

TELEGRAPH CABLE ORDER.—On behalf of the National Construction Commission, the Chinese Government Purchasing Commission has ordered 13,400-ft. of cable, and cable boxes, from Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C. 1. A contract for 850,000-ft. of hard-drawn copper stranded cable has gone to Messrs. Richard Johnson and Nephew, Ltd., Manchester, while from Messrs. Callender's Cable and Construction Co., Ltd., Victoria Embankment, London, W.C. 2, has been ordered twin-core rubber-insulated lead-covered copper wire and 20,000-ft. of underground cable.

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RAILWAYS

NEW CENTRAL STATION.—It has been decided by the Ministry of Railways that the central station of the Canton-Hankow Railway will be located at Wuchang across the river from Hankow.

Steps for the survey of lands to be used for the site of the station have already been taken.

A BIG RAIL ORDER.—For the first time Czechoslovakia has secured a big railway order from China. The Witkowitzer Ironworks has signed a contract with the Chekiang-Kiangsi Railway for the supply of 2,900 wagons, of rails and other materials now being delivered.

The invoice value of the order is 42,000,000 Czech crowns, or £330,000.

NEW RAILWAY ORDER.—Orders are being sent to England for material for the new railway to link up Nanking with Canton, via the Canton-Hankow Railway, an agreement for which was signed with Jardine Engineering Corporation, Ltd., some time ago.

The amount to be spent for this railway in British factories will be £900,000.

S.M.R. FIVE-YEAR PLAN.—The South Manchuria Railway Company's five-year plan is reported to have been approved, and the matter will be submitted to shareholders in July. The company will need Yen 426,000,000 for various enterprises: Yen 102,000,000 for construction of new railway lines, Yen 165,000,000 for railway improvements, including the building of new rolling stocks, Yen 40,000,000 for special enterprises, Yen 53,000,000 for investments in subsidiary companies and Yen 66,000,000 for reserves. The railway is working on the thesis that its part in Manchoukuo's economic construction may be considered finished with the erection of an aluminium industry, the foundation of a company for the production of alcohol and the formation of a coal liquefaction industry.

ELECTRICAL

KOREAN LIGHT AND POWER.—The Oriental Development Company has decided to invest about Y.50,000,000 in light and power enterprises in Korea. The Funei Hydro-Electric Company, with a capital of Y.10,000,000 is to be founded. The company has had an unfortunate experience in financing rice developments and real estate and will now concentrate on electric power.

KYUSHU POWER CO.—The Japanese Government has sanctioned an application of the Kyushu Joint Steam Electric Power Company for permission to increase its generating equipment by 22,000 kilowatts. On completion, the company will be able to generate 80,000 kilowatts. The company is now supplying most of its power to the Mitsui enterprises in Kyushu, but in the future it will supply power to the Toho Electric Power Company and Kumamoto Electric Power Company.

NEW POWER STATIONS.—The Electric Power Federation, which includes the "big five" power companies of Japan, has declined permission to the Toho Power Co. and the Nippon Electric Power Co. to build two steam-generation plants in Nagoya by 1940. The Federation meantime has authorized construction of six water power plants and one steam power plant by Tokyo Electric Light, Toho Electric Power, Daido Electric Power, Ujigaya Electric Power, and the Kyoto Steam Power Companies respectively. Other power stations previously approved for construction follow:

	Maximum power (kw.)	*To be built*
Tokyo Light:		
Shinanogawa second period work . . .	83,150	October, 1940
Toho Power:		
Yamamura station	39,000	October, 1939
Daido Power:		
Nishinogawa station	11,700	October, 1939
Oryu No. 1 station	16,200	October, 1940
Ujigawa Power:		
Totsugawa No. 1 station	12,400	November, 1937
Totsugawa No. 2 station	13,600	November, 1938
Kyodo Steam Power	75,000	November, 1937

The Toyama Prefectural Government has under contemplation the construction of four electric power stations along the Wada River. The Prefectural Government already operates six small power stations along the Wada River. The new plants are estimated to cost Y.24,000,000. Their total generating capacity will be 46,250 kilowatts.

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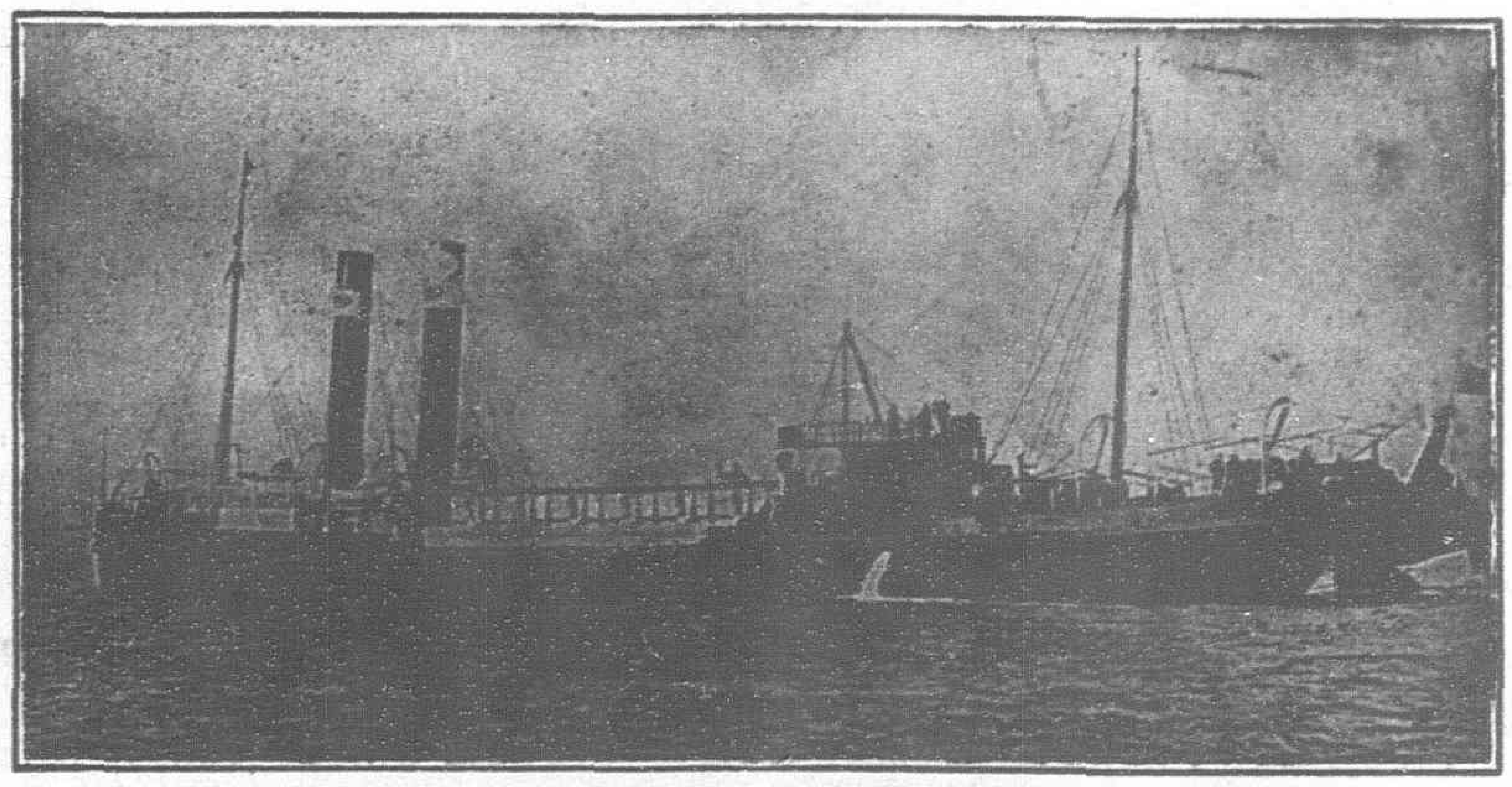

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